CQ

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January 1971
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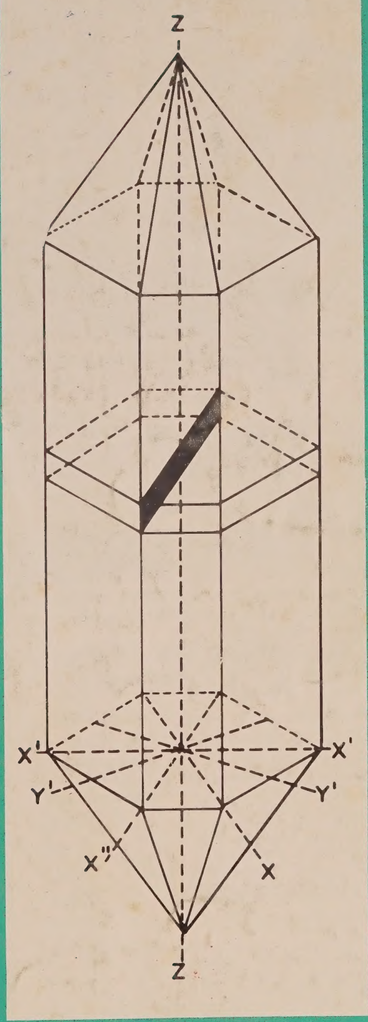


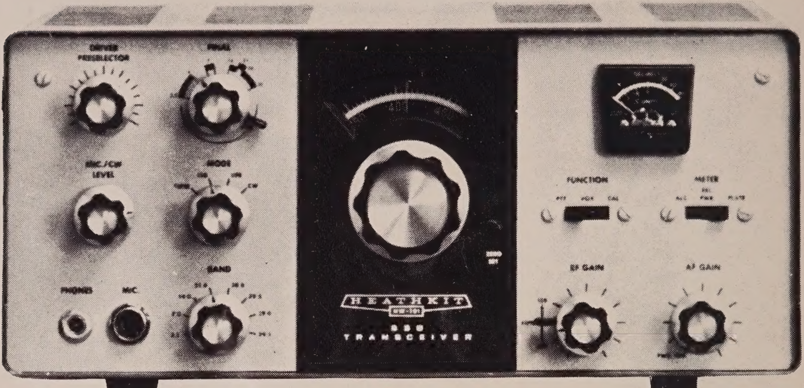
CRYSTAL CALIBRATION

how solid is a rock? p. 38

[redacted]

The Radio Amateur's Journal

better than the "Hot-Water 100" ...and a nickel cheaper



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New Heathkit® Wattmeter... $29.95*

You asked for it... a low cost high quality Heathkit wattmeter. New HM-102 measures RF power output from 10-200 W and 100-2000 W in two switch-selected ranges. Built-in calibrator permits 10% accuracy throughout the 80-10 M bands. Built-in SWR capability. Negligible loss permits permanent insertion in any 50 ohm line. Exclusive remote detector allows placement of meter in any location. Put the new HM-102 in your shack now... it's another powerful value from the Hams at Heath.

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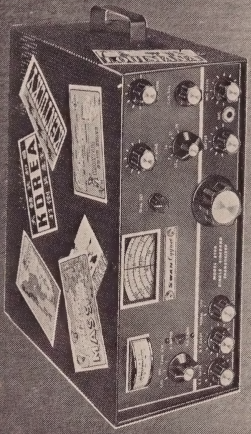

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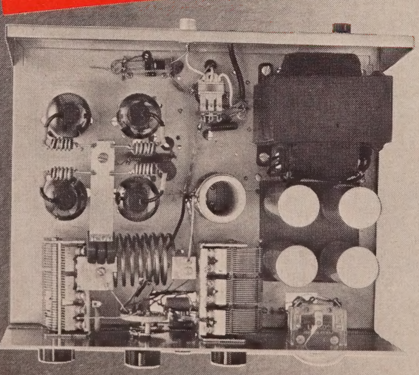

CQ

JANUARY, 1971 VOL. 27, NO. 1

The Radio Amateur's Journal

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Offices: 14 Vanderventer Avenue, Port Washington, L.I., N.Y. 11050. Telephone: 516-883-6200.

CQ (Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: one year, $6.00; two years, $11.00; three years, $15.00. Entire contents copyrighted 1970 by Cowan Publishing Corp. CQ does not assume responsibility for unsolicited manuscripts. Allow six weeks for change of address. Printed in the United States of America.

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OTHER MULTI-BAND ARRAYS AVAILABLE

Elements shortened to show details.

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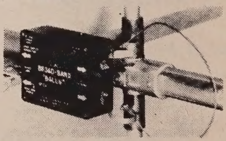

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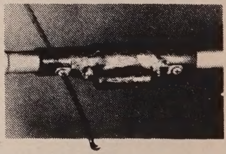

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Mod. 2M814C-	2 mtr.	8 el. array,	16.5 DB gain,	300 W pow. rat.,	1.375"x14' boom	32.50
Mod. 6M5C-	6 mtr.	5 el. array,	13 DB gain,	400 W pow. rat.,	1.5" x 16' boom	39.00

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ZERO BIAS

New EIA Proposal

We, at *CQ,* look to the Electronics Industries Association as a modern, rational voice in affairs dealing with amateur radio and its future. EIA's Amateur Radio Section, in particular, has come up with numerous progressive suggestions in the past year some of which we have greeted favorably; others, of course, we could well have done without.

Recently, a sister section of EIA, the Citizens Radio Section, drafted a proposal which, in our opinion, is so poorly conceived and ill-timed that we're astonished it ever made it to the point of being presented to FCC.

The proposed Rule Making is entitled "Amendment of Part 95 and Part 15 of the Commission's Rules Concerning the Allocation and Assignment of Frequencies for Unlicensed Communication, Class D Citizens Radio Service and a New ProposedClass E Citizens Radio Service".

That's quite a mouthful, and conceals the real meaning of the proposal.

What is this "Class E" Citizens Radio Service? Oh, really nothing more than a new CB service from 146–148 mc! That's half the amateur 2-meter band, in case you just tuned in, and EIA is suggesting that it would be very nice to turn it over to the CB service for channelized wide-band f.m. use with ten watts to the antenna and 50 watts for so-called "special service" licensees.

What is particularly astounding is that EIA has selected one of the most rapidly growing, increasingly-used segments of any of the amateur bands as a target area for future CB service expansion. The area in question, as EIA points out, is covered by international administrative radio agreements, so a resolution to establish 146 – 148 mc as a shared band is proposed for consideration at the next World Administrative Radio Conference of the ITU in 1971. How neat and clever.

It is without reservation that *CQ* goes on record as being vehemently opposed to the institution of any portion of any amateur band as an extension of the Citizen's Radio Service even on a shared basis. We urge the Citizen's Radio Section of EIA to look elsewhere for new territory in which to expand. As a starting point, we suggest EIA investigate the feasibility of restoring the old 465 mc CB band for Class D use, since the basic structure exists, and the band is already allocated to the Citizen's Radio Service. With 1971 technology, inexpensive, effective equipment could easily be manufactured. At any rate, 2-meters is an amateur band, and should remain that way.

F.M. Column

CQ dips its toe into new water this month with the inauguration of a new monthly department in an area we've left largely untouched until now. Under the guidance of f.m. buff, Glen F. Zook, K9STH/5, our new f.m. column will appear on a monthly basis.

Why has *CQ* been so slow coming into the f.m. fold? We're generally pretty cautious people, and until we were sure that we had a man able to give us a monthly column of sufficiently high quality to meet our requirements, we were reluctant to just take anything that happened along. Glen, however, looks as though he'll be able to provide the authoritative leadership necessary to help the fast-growing infant, v.h.f. f.m. along the right road. His column this month begins on page 31. Next month's effort will be of broader scope, reflecting the support of f.m. readers.

A Word of Thanks

During the past three months we've sent out two separate survey questionnaires to different groups of 2,000 *CQ* subscribers each, and thus far have received back just under 1,400 returns. This 35% return has made both surveys a smash success, and has provided us with invaluable market data for our advertisers. Needless to say, we're extremely grateful to all of you who helped us with the survey, and somewhat proud knowing that hams respond so unselfishlessly when called upon for assistance. Our thanks to all of you who helped in this endeavor.

73, Dick, K2MGA

OUR READERS SAY

The Larry Pace Saga

Editor, *CQ:*

I have just read—for the tenth time—Wayne Green's editorial (*73* magazine, August '70) about me and am still wondering *where* he got his "facts" and *why* he bothered to print them. Since the deed is done, I find it necessary to retell the Pace Saga, and place those distorted details in their true light. Wayne writes, "I was there... and I know what happened." Well, he was there (in Amman), although inaccessable and disinterested. Anyway, here's what actually did happen:

I was in Israel when I spoke to Wayne and heard that he was going to visit Jordan. I told him that I, too, might be there and wanted to meet and operate JY1—could he help? Uncertain, he promised to leave a message in American Express in Amman for me with details. Once in Amman, I went first to the Hotel intercontinental, where I assumed he would be—and indeed was—registered, and left him a message to meet me at my camper in the parking lot. He ignored it and I left another the following morning before heading downtown to American Express. It was noontime and the office was closed for lunch, so my wife and I went walking. Not ten minutes later, was my head split by a guerilla. The onlooking crowd watched me beaten by his brass rod and confronted by the barrel of his sub-machine gun when I tried to fight back. Even a policeman gaped. One sympathetic citizen finally thought to call us a taxi and parcelled us off to the hospital for four stitches. The ride, by the way, cost us $2 for four blocks to add, quite literally, insult to injury. The military police were called at the insistance of the attending doctor to investigate and protect us.

They took us to a hotel for our safety and at my request drove me to Wayne's hotel to leave another message. I didn't want to publicize the ordeal on the telephone. I guess my third note to Wayne of "big trouble" finally captured either his attention or curiosity, for he contacted me that afternoon. I told him I was in somewhat poor shape after my downtown visit and he said, ironically, that he'd never left a note at American Express since he had been forewarned of the dangers of venturing downtown. I explained that despite my new white gauze hat and scabby scars I wanted now more than ever before to see the King. He promised to try to arrange something and to phone me later that evening or early the next morning. I mentioned that I would have to leave Amman by noon the next day unless I could see His Highness, since for me Amman was decidedly unsafe. Wayne never did call back, so we left the next afternoon for Syria.

To further elaborate on the situation: Wayne "found some confusion about whether the argument started over (my) wife getting pinched... or (my) taking pictures of some commandos." But there was no "argument." It was an outright attack by a commando on a foreigner. In an Arab nation, my blond hair takes on trademark distinction. The attack was totally unprovoked, either by nationality or religion, as no words were exchanged prior to the blows. Wayne's suggestion that I "photographed some commandos" is absolutely unfounded. We are sufficiently seasoned travellers to know that one does not take photographs in a Moslem country without permission, particularly not in a war zone like Amman. Wayne's allusion to my wife's "getting pinched" is an equally untrue trigger of the event. She got pinched while I was getting beaten.

I wrote to His Highness immediately after leaving Jordan and have not to date received a reply. This does not show the "sincere regret" Wayne ascribes to the King. It is incongruous, too, that Wayne was too busy to contact me *before* the incident, but free enough after it to do all that checking and speculating on the situation. He could have contacted me; at least *I* would have told him the truth had I known he'd want to print the story and saved many a reader from confusion.

In that same editoral, in which Wayne doesn't want to do me an injustice, as he says, he makes a very large negative reference to my endeavor for a Lacadives license. VU2NR, he says, cannot get the ticket, so why should I?, is his complaint in this department. Some one should tell Wayne that VU2NR has been in Aden for the last year and a half. I'm making every effort my resources will permit, paying the bills and hearing the frustrations, and even if I don't get to go, at least I will have tried and paved the way for someone else. There are at least a dozen Indian hams who are also trying and who have offered me their help and cooperation, for which I am most grateful. This is the kind of fraternity hams everywhere should feel, not the mud-slinging mockery expressed by Wayne Green.

Larry Pace, K2IXP/VU2IXP
New Delhi, India

RM-1633 Proposal

Editor, *CQ:*

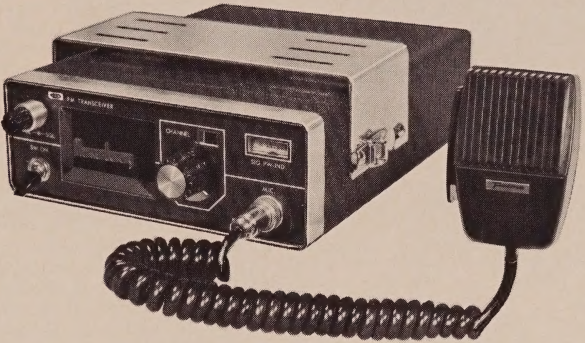
You are to be congratulated on being "big" enough to take a stand against RM-1633 as you did in the November ZERO BIAS editorial, especially since, as you pointed out, it is not much different from a proposal originally made by *CQ* several years ago.

I suppose we should thank Wayne Green for "taking the rag offen the bush!" But the pity is that you could not have seen the potential hazard of such a proposition long ago (as many of us did and told you so). I cannot subscribe to your reasoning in the last paragraph of ZERO BIAS on page 5 of the cited issue, where you say: "We feel that the original intent behind RM-1633 would have been a vital shot in the arm..."

At last—Drake quality in a
VHF FM Transceiver

DRAKE

Marker Luxury



The best of the Japanese, the Marker Luxury VHF FM Transceiver is built for and distributed and backed by the R. L. Drake Co.

- **Exceptional receiver**
- **Backed by R. L. Drake**
- **Complete package for . . .**

$329.95

Includes transceiver, two channels supplied, mobile mount, microphone, coax cable and antenna.

SPECIFICATIONS

General

Frequency Coverage	144-148 MHz
Number of Channels	12 Channels, 2 supplied Channel 1 Receive 146.94 MHz Transmit 146.34 MHz Channel 2 Simplex 146.94 MHz
Modulation	Frequency Modulation
Transmitter Control	Push-to-Talk
Power Drain	AC: Receive 6 Watts Transmit 50 Watts DC: Receive 0.5 Amps Transmit 4 Amps
Power Source	AC: 117 Volts Factory Wired 220/240 Volts 50-60 Hz DC: 13.5 Volts ±10%.
Dimensions	7⅞″ W x 2¾″ H x 10¼″ D.
Weight	8¼ lbs.
Standard Accessories	Dynamic Microphone, Antenna, Connector Plug, AC/DC Cord

Transmitter

RF Output Power	10 Watts
Frequency Deviation	15 KHz maximum
Frequency Stability	±.001% or less
Spurious Radiation	Greater than —80 dB below Carrier
Frequency Multiplication	12

Receiver

Receiver Circuit	Crystal-controlled Double Conversion Superheterodyne
Intermediate Frequencies	1st 10.7 MHz, 2nd 455 kHz
Input Impedance	50 to 75 Ohms
Sensitivity	0.5 μV or less for 20 dB S+N/N ratio 1 μV or less (30 dB S+N/N ratio at 10 kHz deviation with 1 kHz modulation)
Intermodulation	Greater than 80 dB
Spurious Sensitivity	At 40 kHz separation
Audio Output	Greater than −80 dB 0.5 Watt with 10% or less distortion.

See at your distributor, or write for details . . .

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540 RICHARD ST., MIAMISBURG, OHIO 45342

My dear Mr. Ross, it was as wrong then as it is today and the results would have been exactly the same, Wayne Green's headlines notwithstanding.

Now that I have castigated the editor, I have this to say to all licensed amateurs: If you have strong feelings about this preposterous proposal —which could well mean the beginning of the end of ham radio as we know it today—for God's sake *do* something about it! Write the FCC and/or your Congressman. Don't just gripe about it on the air as was done with the incentive licensing proposal. Remember, it *can* happen here!

J. Harvey Chase, W4JG
Wayside, Ga.

CQ Reviews Collins

The following letter typifies hundreds over the last several years in response to *CQ*'s new equipment reviews by Wilfred M. Scherer, W2AEF, our Technical Director. We couldn't be prouder than we are to have Bill on our full-time staff.

Dear Mr. Scherer:

I would like to congratulate you and thank you for two fine articles on Collins equipment (S-Line review Dec. '69 and 30L-1 review Oct. '70). I did not know much about actual Collins design considerations nor, for that matter, much about other equipment circuitry. Your articles, particularly the S-Line review, revealed there's more to Collins than I ever realized and I was stimulated to do further reading and study so that I have learned more since Dec. '69 than in my 12 years in ham radio. Your articles were quite thorough and more than just a review of equipment; they were more like seminars in theory and design considerations.

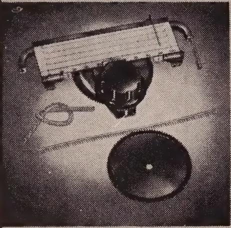
Since transceivers are so popular today, I think it would be a logical and well received move to review the KWM-2. I am aware that the M-2 has provisions for a noise blanker and Q-multiplier and I think it would be a step beyond normal review articles to comment on adding of these features. This would be a useful service to would-be purchasers.

Again, many thanks for your fine Collins articles and I hope you can wrap them up with a KWM-2 review.

E. B. Tilton, Jr. K5RSG
New Orleans, La.

designed for application

PRECISION COMPONENTS FOR THE RADIO AMATEUR



No. 10037
NO-STRING DIAL

No strings—no backlash. The pointer is driven by a flexible toothed rack riding in an extruded aluminum channel. Illuminated slide rule dial with 11.1 ratio. Scale length 6½". For behind panel mount. $13.05

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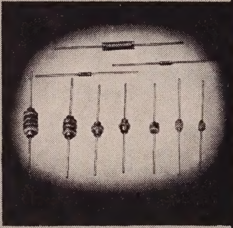
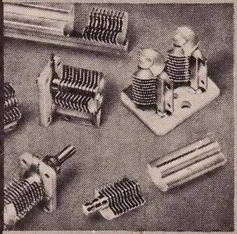
220 mc	34300-0.82	$ .59
TWO Meters	34300-2.7	.59
SIX Meters	J300-8.2	.74
6/10 Meters	34300-22	.59
TEN Meters	J300-25	.84
10/15 Meters	34300-68	.59
10/15/20 Meters	34300-50	.59
20 Meters	34300-100	.59
40/20 Meters	34300-500	.59
80 Meters	J300-360	.95
80/40 Meters	34300-1000	.59
160 Meters	J300-1200	.95
LOW FREQ.	J300-1500	.95
ALL BAND	34300-2500	.59





No. 25000
CAPACITORS

Millen No.	Capacity	Price
25009-E	1.6 - 9.3 pf	$2.19
25012-E	1.9 - 12.8 pf	2.27
25015-E	2.4 - 15.7 pf	2.30
25025-E	3.2 - 25.2 pf	2.70
25035-E	4.4 - 35.0 pf	2.92
25009-S	1.6 - 9.3 pf	1.84
25012-S	1.9 - 12.8 pf	1.97
25015-S	2.2 - 15.7 pf	1:97
25025-S	3.0 - 25.5 pf	2.43
25035-S	4.0 - 35.8 pf	2.69
25009-T	1.6 - 9.3 pf	1.84
25012-T	1.9 - 12.8 pf	1.97
25015-T	2.2 - 15.7 pf	1.97
25025-T	3.0 - 25.5 pf	2.43
25035-T	4.0 - 35.8 pf	2.69

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GRID DIP METER

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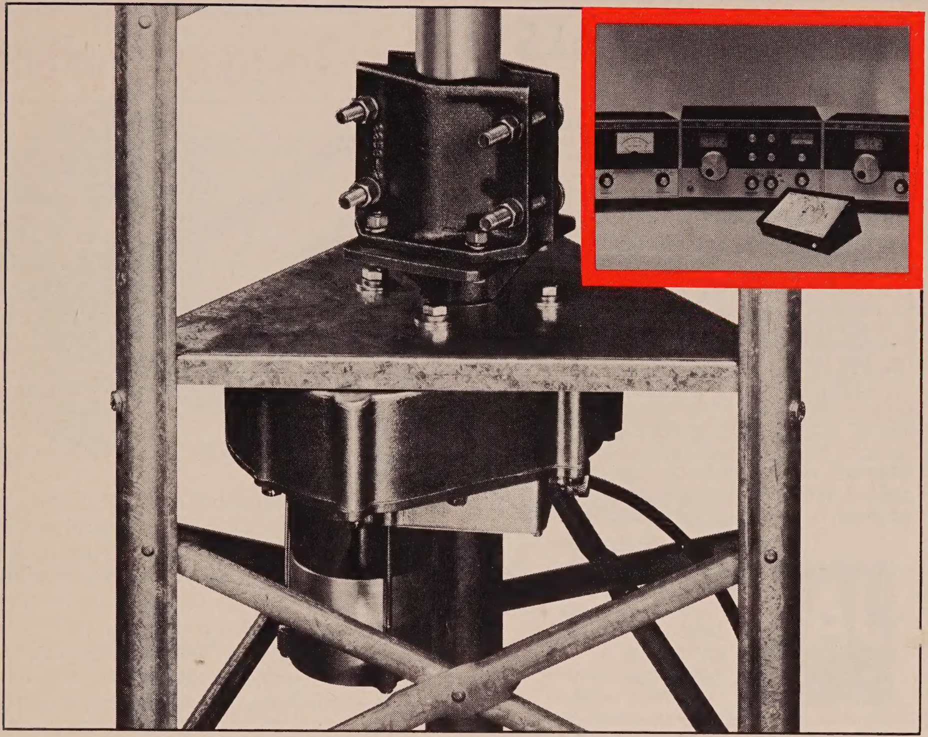

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The ROTO-BRAKE delivers over 4,000 IN/LBS of starting and rotating torque. Brake slips at 5,000 IN/LBS to prevent damage to parts. Motor and gear train are protected by husky cast aluminum housing.

Handsome control unit features sweep pointer over choice of great circle map or compass rose. Select desired position and capacitor-start rotator (operating off 110VAC 60 cycle power source through five-conductor cable) moves until null seeking circuit brings into position. No blind spots. As a matter of fact, rotator will move 380°, giving you a generous overlap. And, if antenna should move during severe environmental conditions, it will automatically return to original position when control is activated. All circuitry is highly reliable—no troublesome selsyns used.

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There's just nothing like the ROTO-BRAKE for performance. Buy one from the best distributor under the sun—the one who stocks Hy-Gain.

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Price is F.O.B. Winnipeg
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Buy two elements now – a third and fourth may be added later with little effort.

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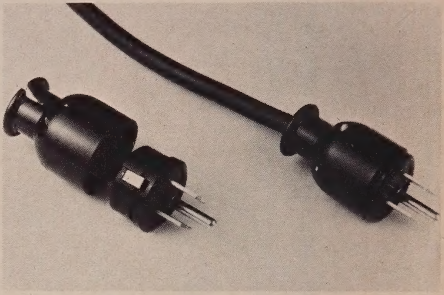
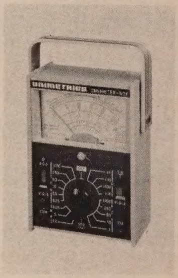


Amphenol All-plastic Strain Relief Caps

A NEW, two piece black plastic strain relief cap easily assembled to all Amphenol grooved octal sockets, line plugs, outlet plugs a.c. receptacles has been added to the Amphenol line. The part number for the strain relief cap is 3-858 and will clamp cables up to 5/16″ in diameter. The two halfs of the cap are secured by two concealed screws. For more information write to Amphenol Industrial Division, 1830 South 54th Ave., Chicago, Ill., 60650 or circle 8 on page 94.



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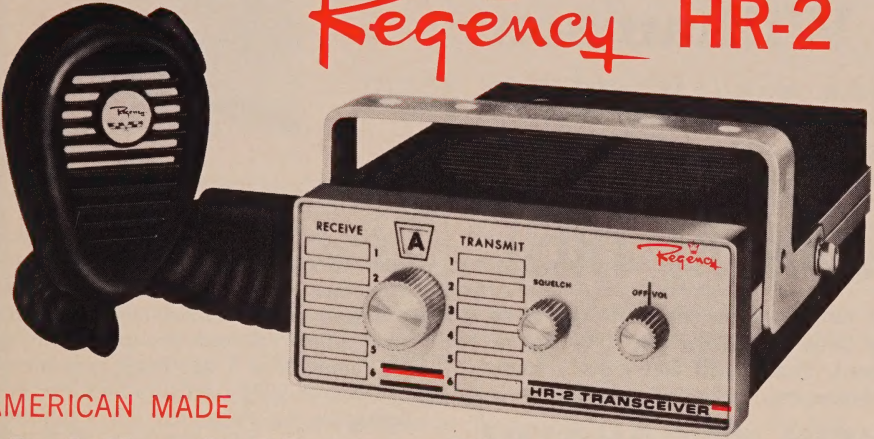
UNIMETRICS introduces the Omnimeter-50K a 50K ohms per volt v.o.m. with operational features which include: mirror scale and single selector switch, easy access battery compartment, diode protected meter movement, a.c. rectifier pre-calibrated for easy replacement, and a very rugged case. Complete specifications and price can be had by writing to Unimetrics, Inc., 23 West Mall, Plainview, N.Y. 11803 or circling 9 on page 94.

Regency HR-2



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Mobile 2 Meter FM Transceiver

Here is what the 2 meter, FM Ham World has been asking for.

Specifications: 90 day warranty

RECEIVER

The HR-2 receiver is a double conversion, superhetrodyne with highly selective ceramic filter.

Frequency Range	144-148 MHz
Sensitivity	0.35 µv (nom.) 20DB Quieting
Selectivity	6DB Down ± 16KC 50DB Down ± 32KC
Audio Output (3-4 Ω Speaker)	3 Watts 10% Distortion 5 Watts Maximum
Channels	6 Crystal controlled with provision for adding an additional 6 channels
I.F. Frequencies	10.7 MHz & 455KHz

TRANSMITTER

The HR-2 transmitter uses phase modulation for the ultimate in carrier stability. Built in SWR load mismatch circuitry provides protection against open and shorted antenna conditions.

Frequency Range	144-148 MHz
Power Output	10 Watts (min.) @ 13.6 VDC
Modulation	Phase Modulation with automatic deviation limiting
Deviation	Automatic Limiting with internal adjustments from 0-15KC deviation
Microphone	Plug-in, hand held, high Z Ceramic supplied
Channels	6 Crystal controlled with individual trimmer capacitors for Frequency netting

GENERAL

Power Requirements	13.6 Volts (nominal)
Receive (Squelched)	180 MA.
Receive (Max. audio output)	800 MA.
Transmit	2.5 Amps (max.)

STANDARD EQUIPMENT

- Built-in 4″ Speaker
- Mobile Mounting Bracket
- SO-239 Antenna Connector Socket
- T & R Crystals for 146.94 MHz
- PTT Ceramic Mike

only $22900 Amateur Net

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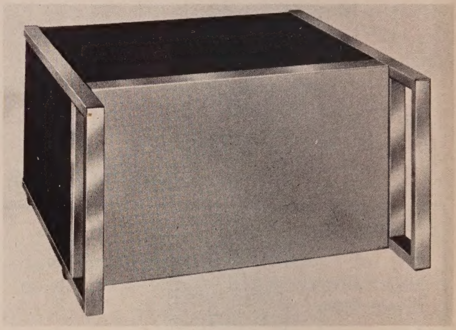
Amphenol R.F. Connectors

THIRTY-ONE new r.f. coaxial connectors, called "Astroplate", have more than doubled the number of tarnish-free, corrosion-resistant plated connectors available from Amphenol. The new line includes the type N and TNC families and a significant expansion of the BNC and UHF configurations. For more information on Astroplate r.f. connectors, contact Amphenol Sales Division, 2875 South 25th Ave., Broadview, Ill., 60153 or circle 4 on page 94.



Beechwood Custom Cabinets

BEECHWOOD Manufacturing Corp., announces the 600 series custom cabinet line. Thirty-two styles and sizes are available to meet just about any requirement. Top, bottom, front, rear, and side panels are removeable for immediate access to the inside of the cabinet. Front and rear panels are supplied with each cabinet. The cabinets are constructed of stainless steel frames with laminated vinyl panels in a choice of three colors: Jet black, suede gray, and moss green. Prices start at $35, and delivery takes two weeks. For complete specifications write to Robert H. Newsom, Kentron Corp., 411 South Riter Ave., Indianapolis, Indiana 46219 or circle 5 on page 94.

The most powerful antennas under the sun!

Now...Efficient Five Band Operation with HY-GAIN'S 14 AVQ/WB made possible by

NEW TOP LOADING COIL CONVERSION KIT

The first, most copied and still the greatest multi-band vertical, Hy-Gain's 14 AVQ/WB is built basically for 40 through 10 meters.

Now you can also get optimum performance on 75 meters with the LC-75-T conversion kit. It's more efficient because it's top loading; it accepts maximum legal power; and it can be easily attached or detached. Provides 100 KC bandwidth at 2:1 SWR.

If you're already operating with a 14 AVQ/WB, why not look into the possibilities of the LC-75-T kit? Or if you are not yet enjoying all the advantages of this unrivalled vertical, consider these features:

- Wide band operation with just one setting (although we still give you two settings for phone or CW).
- Exactingly spaced, large diameter Hy-Gain Hy-Q traps with exceptionally favorable L/C ratio for maximum efficiency.
- Traps wound on low loss polystyrene cores to eliminate detuning through moisture absorption.
- Traps precisely tuned electrically for optimum performance across the band.
- All elements taper swaged for less wind loading and greater strength.
- Full circumference clamps of aluminum; no dissimilar metals; no damage to tubing.
- Exclusive DC ground feature to drain off precipitation static.
- Nominal 52 ohms at resonance feed for lowest SWR.
- Mechanical parts precision cut and deburred for professional fit.
- All aluminum brackets for years of service with no corrosion.
- For better matching sealed SO-239 connector.
- Can be ground or roof mounted.

Antenna 14 AVQ/WB (Order No. 385)—Suggested retail price **$39.95.**

Conversion kit LC-75-T (Order No. 200)—Suggested retail price **$21.95.**

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HY-GAIN ELECTRONICS CORPORATION

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EIMAC's new 8873 family of grounded grid, zero bias triodes offers you top-man-on-the-frequency performance to 432 MHz.

(Imagine how these tubes will work at 14 MHz).

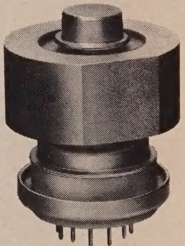
EIMAC's many contributions to grounded grid triode design and production have now been combined with the advantage of rugged, low-profile ceramic/metal assembly to bring you this new family of impressive high-mu triodes. They're inexpensive, and work up to 1000 watts PEP input at frequencies up through 432 MHz. Quickly, here are the outstanding features of these state-of-the-art tubes:

88 and 73

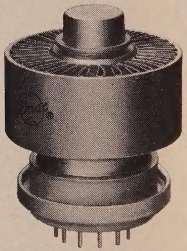
The numerals 88 and 73 have been a tradition in communications language for almost 120 years. The older of the two, 73, appeared in 1853, meaning "My love to you." In 1857, the first official definition made it a "fraternal greeting between operators." Two years later, 1859, Western Union made "73" a part of their "92 Code" to indicate "Accept my compliments." The final change came in 1895, when "73" meant "Best Regards" for the telegraph, and later for radio operators.

"88" never received the formality of an official listing until it was adopted as one of the "Ham Abbreviations." It had been one of the telegraph operators' traditional terms since well before the turn of the Century. During the First World War, "88" was used by the U. S. Army Signal Corps, again strictly as an operator's abbreviation in unofficial communications. At the close of WWI, "88" achieved official status as a part of amateur radio terminology: "love and kisses."

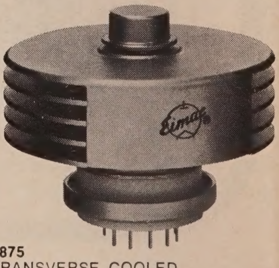
Louise Ramsey Moreau,
WB6BBO/W3WRE



8873
CONDUCTION COOLED ANODE



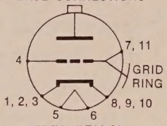
8874
AXIAL COOLED ANODE



8875
TRANSVERSE COOLED ANODE

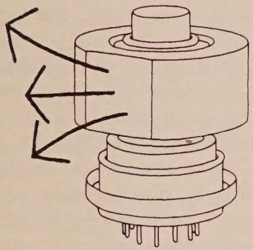
1. Up to 1000 watts PEP input per tube to 432 MHz. Typically, 2000 volts at peak dc plate current of 500 milliamperes.
2. Indirectly heated cathode. No expensive filament choke needed for grounded grid HF operation as filament is electrically isolated from cathode.
3. Easy to drive. Extremely low grid interception plus EIMAC's exclusive self-focusing cathode combine to provide high power gain, high overall efficiency and low, low intermodulation distortion.
4. May be driven to full rated input with solid state driver in many cases.
5. Inexpensive ($1.25) socket. No air ducting required. No expensive glass chimney. 11-pin low inductance base and VHF grid ring provide excellent intra-stage isolation.
6. Heat sink cooling available to full anode dissipation.
7. Tubes may be mounted in any position, greatly aiding circuit layout.
8. And, of course, no bulky screen or bias supply needed!

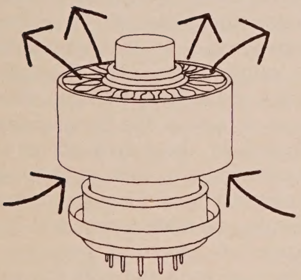
8873 FAMILY BASE CONNECTIONS

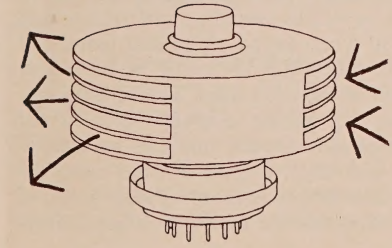


JEDEC #E11-81

Another example of EIMAC's ability to provide tomorrow's tubes today!







Here are the numbers to prove it:

The EIMAC 8873 is a grounded grid triode designed for conduction cooling to a heat sink. See this 1971 design in tomorrow's ham gear.

The EIMAC 8874 is electrically equivalent to the 8873 but has a 400 watt anode designed for axial-flow, forced air cooling.

The EIMAC 8875 is also similar to the 8873 with a 300 watt anode designed for transverse air cooling with a quiet and inexpensive "phono motor" fan.

A pair of any of these exceptional triodes will fit in the palm of your hand. And will provide you a full 2000 watts PEP input for voice. They're rated for continuous RTTY service, too. We've built a single tube kilowatt 432 MHz stripline amplifier. It'll run 50% overall efficiency with 25 watts drive. More than adequate for successful moonbounce operation!

14 MHz DX operation . . . RTTY . . . moonbounce at 432 MHz . . . widely separated goals, but all met by one family of rugged, ceramic/metal grounded grid triodes, by EIMAC.

TYPICAL OPERATION, INTERMITTENT VOICE SERVICE TO 30 MHz

Plate Voltage	Zero-Signal Plate Current	Single-Tone IVS Plate Current	Useful Power Output
2000 V	22 mA	500 mA	587 W
Peak Drive Power	Cathode Voltage	Resonant Load Impedance	Intermodulation Distortion Products
26 W	+8.2 V	2140Ω	3rd order: —35dB 5th order: —36dB

Write to EIMAC for full details and suggested circuitry for this new family of tubes. The 8873, 8874 and 8875. And 8873 to you. EIMAC, 301 Industrial Way, San Carlos, California 94070. Phone: (415) 592-1221.

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QSK WITH THE HEATH SB-SERIES EQUIPMENT

DAVID C. KOCHENDARFER,* K4DC

True break-in operation is not only desirable for convenient high-speed c.w. rag-chewing, but is a must for fast, efficient c.w. traffic handling. The simple modifications to the Heathkit SB-series equipment described below enable such operation without sacrificing ease of operation in the s.s.b. mode.

UPON critical examination of the commercially-built and kit equipment available to today's amateur, one finds that the design effort has been directed to producing equipment which provides optimum performance in s.s.b. operation, but in which the c.w. mode has been treated as an afterthought. This opinion derives from the quasi-break-in type of c.w. operation offered—where the first key character, operating through the VOX control circuitry, causes the transmitter to be activated and the receiver muted. The sending operator cannot hear a breaking signal between his keying characters and must pause momentarily to permit the VOX control to drop out before the breaking station can be heard. A second disadvantage found in this type of operation is that frequently the first keyed character is cut short by the inherent delay in VOX pickup. Conversely, the ideal c.w. station provides instantaneous response in the transmitter, with no key-up signal apparent in the receiver, and with receiver muting (or reduction in gain) occurring at the keying rate. The full impact of QSK can be seen if one copies two stations who are passing traffic, where the receiving operator needs only touch his key to interrupt the sending station and get fills for any portions he cight have missed.

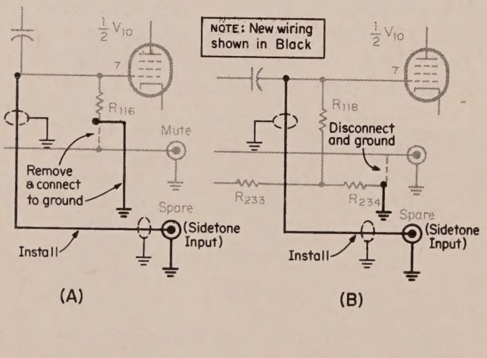

Fig. 1—(A) Modification of the Heathkit SB-300 receiver muting circuit to permit injection of a c.w. sidetone on transmit. (B) Similar modification for the SB-301.

Many of today's s.s.b. transmitters are of the "filter" type, using heterodyne techniques for signal generation, and in which we find no oscillators operating at or on submultiples of the desired output frequency. Certain inherent features of the heterodyne method of signal generation and of the linear mode of operation found in the stages of an s.s.b. transmitter contribute to making this equipment an excellent choice for c.w. operating. The first feature one finds is that with a reasonable degree of interstage isolation and power supply regulation and with keying the mixer stages, all the oscillators can be left running (including the v.f.o., of course) without producing a key-up signal in one's own receiver, as well as providing a chirp-free output signal when keyed. A second feature of the s.s.b. transmitter is found in the linear operation of the r.f. stages. This enables one to shape the keying characteristics in the low-level stages (where this can be accomplished with relative ease) and not have the shaping changed by succeeding high-powered stages—as is often the case with Class-C oper-

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*9913 Woodrow St., Vienna, Va. 22180.

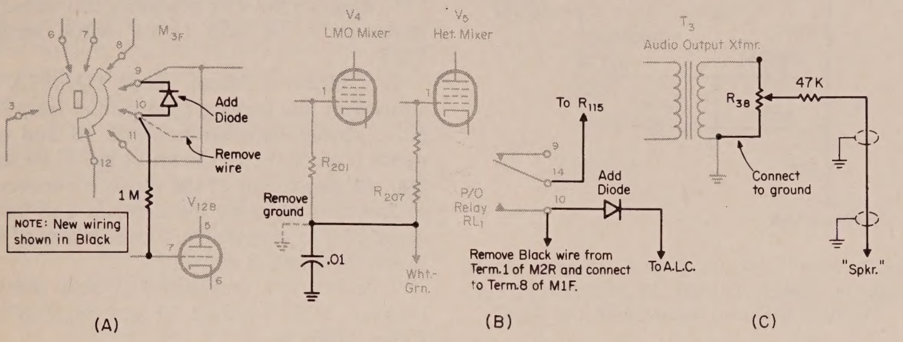

Fig. 2—SB-401 transmitter modifications. (A) Mode switch changes to continuously energize control relay. (B) Keying modifications to permit transceive operation with the Freq. Control switch in the Locked position. (C) Sidetone circuit changes to allow setting sidetone level and feeding to receiver without disturbing receiver gain controls.

ation. The third advantage is found in the inherently lower level of harmonic generation in linear stages compared with those operating Class-C—a distinct help to those plagued with the ever-present TVI problems.

The popular and widely used Heathkit SB-Series equipment is representative of the general line of "filter" type of s.s.b. gear. In common with most of the commercially available equipment, the SB-Series offers the c.w. operator a quasi-break-in type of operation as previously discussed. Having previously modified other equipment for full break-in operation, and at the suggestion of WB2-YYP, it was decided to see what could be done to provide full break-in c.w. operation with the Heathkit gear. The specific equipments to which these changes were made are the SB-300 receiver and SB-401 transmitter. Examination of the SB-400 circuitry indicates the feasibility of similar changes to this equipment. Inspection of the SB-301 schematic indicates that the modifications to this receiver, while differing from those in the SB-300, are equally as feasible and simple to accomplish.

Receiver Modifications

Modification of the SB-300 receiver for full break-in proved to be the easiest to accomplish. The first step was to determine whether the receiver could be turned on and off at a high keying speed by keying the muting line. This was found to be entirely feasible, even with the a.g.c. switch in the SLOW AGC position. Examination of the receiver a.g.c. circuitry shows that the capacitor responsible for the long time constant when in the SLOW AGC position, C_{223}, is connected to the muting line rather than direct to ground. With this arrangement, the blocking voltage of about 30 volts is not applied to C_{223} and the long time constant of C_{223} and R_{211} (about 1 second) does not affect the muting action in the receiver. Further analysis of the circuit shows that the time constant which might influence the muting action is about 11 milliseconds, which is insignificant at the highest keying speeds used. Therefore, no changes are necessary for proper muting.

One necessary feature in c.w. operation is to be able to monitor one's own keying and the most convenient method is through the receiver audio system. Some operators prefer to monitor their own transmitted signal—which practice has much to recommend it—but is not always practicable, particularly when both stations in QSO are not operating on or close to the same frequency. An alternate practice is to generate an audio frequency sidetone keyed along with the transmitter, and fed to a speaker or one-half of a split headset. A very simple modification to the receiver shown in fig. 1(A) permits feeding the keying sidetone directly into the receiver audio circuit, to be available in the speaker or at the headset.

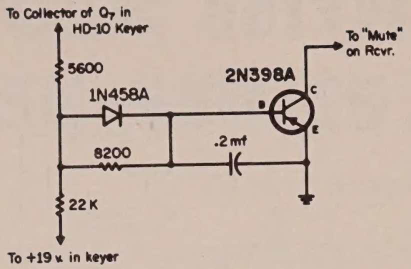

Fig. 3—Modification to allow the Heathkit HD-10 keyer to directly key the SB-300/SB-401 combination without a separate keying relay.

In the SB-300 we find that the grid resistor of the audio output stage, R_{116}, is returned to the muting line instead of to ground, which cuts this stage off when the receiver is muted. In order to provide the sidetone output, this resistor must be returned to ground, which is accomplished as follows.

1. Locate the yellow wire which is connected between point F of the i.f. printed circuit board and terminal 9 of terminal strip J. (The SB-300 manual will indicate these points.)

2. Remove this wire from terminal 9 and connect to the ground lug, terminal 8 of this same strip.

3. Connect a length of small shielded wire (such as RG-174/U) between one of the "Spare" phono jacks on rear apron of receiver and the grid (pin 7) of the 2nd Audio stage (V_{10}). This jack now becomes "Sidetone Input."

Unlike the SB-300 which uses cathode resistor biasing, the audio output stage in the SB-301 utilizes fixed bias, obtained from a voltage divider as shown in fig. 1(B). The voltage divider, consisting of R_{233} and R_{234}, is connected between the bias voltage supply and the muting line. Permitting this stage to operate when the receiver is in the muted condition is accomplished by disconnecting one end of R_{234} from the muting line and grounding this end of the resistor. The sidetone may be fed to the audio in the same manner as in the SB-300.

This completes the receiver modifications.

Transmitter Modifications

For full break-in operation of the SB-401 transmitter, it is desirable for the control relay to be permanently energized when in the c.w. position, instead of being actuated through the VOX circuit as is normally done. These changes, shown in fig. 2(A), are accomplished as follows:

1. Remove the wire presently connected to terminals 9, 10, and 11 of switch section M3F.

2. Connect a silicon diode (1N487A or equivalent low leakage type with at least 300 p.i.v. rating) between terminal 10 and terminal 9 of M3F, as shown in fig. 2. Be sure that the anode end of the diode is connected to terminal 10 with the cathode end being connected to terminal 9. Connect a wire between terminals 9 and 11.

3. Install a 1 megohm 1/2 watt resistor between M3F terminal 10 and pin 7 of the Relay Amp., V_{12B}.

The above changes permit the energizing of the control relay when the MODE switch is in the c.w. position, but allow normal operation of the transmitter in s.s.b.

One of the problems encountered with this equipment was in attempting to operate transcieve with the FREQ. CONTROL switch in the LOCKED position. The problem stemmed from the fact that the 3395.4 kc signal from the carrier generator was feeding through the cabling back into the receiver, mixing with the 3396.4 kc b.f.o. signal and producing a 1 kc beat note. This problem was cured by adding the Isolation Amplifier, V_3, and the LMO Mixer, V_4, to the keyed stages and these changes are accomplished as shown in fig. 2(B) as follows:

1. Disconnect the WHT-BRN wire from terminal 10 of the relay.

2. Install a silicon diode (any will do here) with its anode end connected to the relay terminal 10, and its cathode connected to a single insulated terminal mounted with one of the screws near V_4 at the corner of the mixer-bandpass board.

3. Connect the WHT-BRN wire to the cathode of the diode.

4. Remove the BLK wire from terminal 1 of M2R and connect to terminal 8 of M1F.

5. Lift the lower end of R_{201} from ground to connect to the lower end of R_{207}. This can be accomplished by installing a single insulated terminal on the *top* of the chassis, using the same screw as indicated in step 2 above. The presently grounded end of R_{201} can be unsoldered from the board and fastened to the terminal, the .01 mf capacitor connected from the terminal to the hole vacated by R_{201}, and a wire run from the terminal to point G on the board.

The only change introduced by the above

modifications is that the key must be closed in order to tune up when in the TUNE position.

The remaining modifications in the transmitter involve the sidetone circuitry, to permit feeding the keying sidetone through the receiver audio circuit. These changes consist of the following:

1. Replace the 200 ohm resistor R_{38} with a 500K potentiometer.
2. Install a 47K 1/2 watt resistor at the center terminal (wiper) of the potentiometer, and connect the center conductor of the shielded wire going to terminal 13 of the relay to the other end of this 47K resistor. See fig. 2(C).
3. Ground the lower terminal of the potentiometer.

These changes permit feeding and mixing the keying sidetone in the receiver audio circuit, and permit adjustment of the sidetone level independently of the setting of the receiver gain controls.

With these modifications to the transmitter, the control and antenna switchover relays are continuously energized when in the c.w. mode position, and do not provide for switchover of the antenna to the receiver. This problem can be taken care of by either: (1) separate antennas for the transmitter and receiver, or (2) using a T-R switch. The second alternative is the preferred one, particularly when using a beam antenna on the higher frequencies, and even on the lower frequencies where the receiving and transmitting patterns of an antenna for a given frequency are usually identical. The often mentioned TVI problems caused by a T-R switch have not been experienced by the author. At this QTH we use a Johnson 250-39 T-R switch with a Transmatch tuner between the switch and the antenna. This arrangement provides considerable attenuation of harmonics and helps keep the author's station TVI free.

Keyer Considerations

The simplest method of keying the transmitter/receiver combination is with a s.p.d.t. keying relay, connecting the normally open contact to the transmitter key input and the normally closed contact to the receiver mute input. However, since some electronic keyers, such as the Heath HD-10, use a transistor switch to key the transmitter, it was decided to stick with transistor switching and not get involved with relays. A simple circuit, fig. 3, was worked out, which when added to the HD-10 provides keying for the receiver mute circuitry. The diode and capacitor circuit provides a slight turn-on delay for the receiver, to insure that it does not come on until the transmitter signal is off. This is of particular importance when operating in the SLOW AGC mode, since any transmitter signal feeding into the receiver after it has been turned on will "hang up" the a.g.c. and keep one from hearing any breaking signals. The values shown give a delay of about 1.6 milliseconds and seem to be adequate in SB-300/401 setup tested. However, if longer delays are needed, they can be obtained by increasing the size of the capacitor—1.0 mf would give a delay time of about 8 milliseconds, which should be sufficiently long for any transmitter/receiver combination.

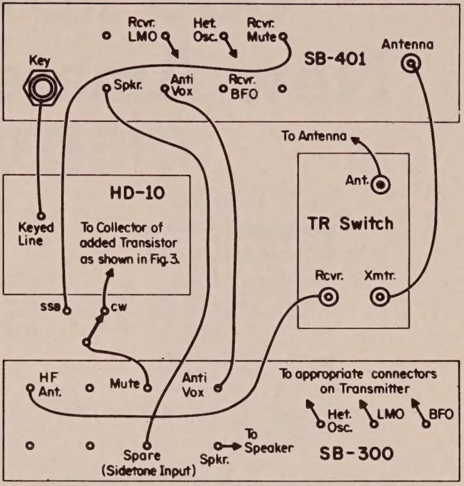

Fig. 4—Revised station wiring for full break-in c.w. operation using an electronic antenna T-R switch.

Station Cabling

In cabling the receiver and transmitter together, a few changes from the standard cabling must be made, and the complete station cabling diagram is given in fig. 4.

The equipment modifications described in the foregoing provide full break-in c.w. operation of the SB-300/401 combination in either separate tuning or transceive mode, and do not interfere with normal operation of the equipment on s.s.b. The author wishes to acknowledge the help of Charles Stantial, WB2YYP, in working out the actual circuit changes in his own equipment, and to thank Frank Williams, WB4GTS, for the several discussions and helpful suggestions during the course of this effort. ■

New Amateur Products

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A NEW revised and expanded transistor, rectifier, and diode interchangeability guide can now be obtained from Semitronics Corp. The new guide lists over 100 basic types of semiconductors than can be used as substitutes for over 12,000 types. This guide may be obtained free from local Semitron distributors or directly from Semitronics Corp., 265 Canal Street, N.Y., N.Y. 10013. For further information circle 1 on page 94.

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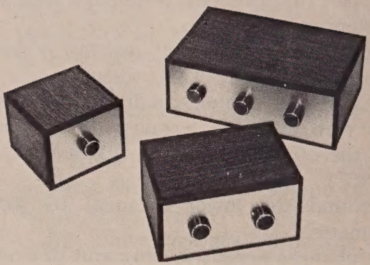
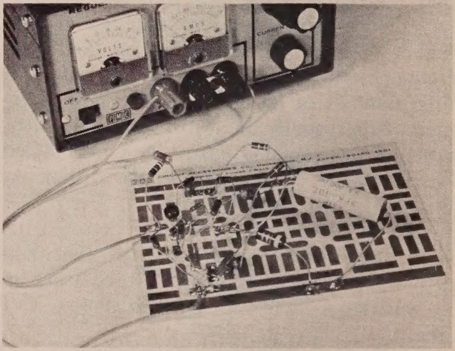
RECHARGE and save is the theme for the consumer line of alkaline rechargeable batteries now being offered by RCA. The new line claims 35 to 50 times the service of conventional carbon zinc types when properly used and charged. Optional list prices (packaged two per card) are: VS1513 "D" cell–$3.50, VS1514 "C" cell–$3.00, and VS1515 "AA" cell–$2.00. The BC-16 charger carries an optional list price of $8.95 each. For more information on RCA battery products circle 3 on page 94.



EICO Flexi-Cab Cabinets

EICO is now marketing a line of vinyl-clad steel cabinets to compliment their line of EICOcraft solid-state projects as well as house other small electronic gear. The cabinets, called Flexi-Cabs, assemble quickly and add a finished professional look to any project. For complete details write to EICO, Electronic Instrument Corp., Inc., 283 Malta St., Bklyn., N.Y. 11207 or circle 2 on page 94.

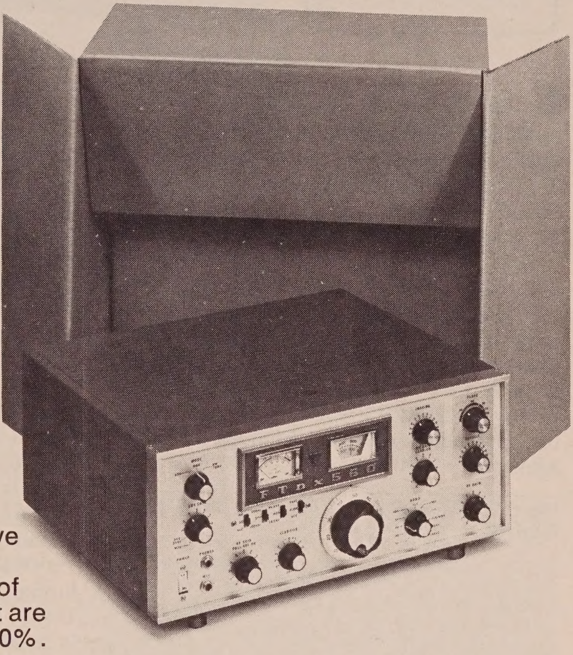


Circuit Accessories Experi/Board

AN epoxy-fiberglass board with wide copper channels form the new Experi/Board, a breadboarding aid for engineers, technicians and experimenters. The re-usable Experi/Board saves time because components can be soldered directly to the lift resistant copper lands with no drilling or mounting necessary. Six different sizes and styles are available at prices from $1.95 to $3.75 each. For further information contact Circuit Accessories Co., 514 S. River St. Hackensack, N.J. 07601 or circle 7 on page 94.

The Yaesu FTdx 560 is a great rig, but it's no bargain.

At $450, it's a steal.



Considering all the FTdx 560 offers, you might think its $450 price tag was for a kit. But it isn't.

You get a powerful, air-ready station. A handsome, completely hand-crafted transceiver that's fully guaranteed for one year.

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One more point: About 90% of the amateur stations in the Orient are Yaesu; in Europe, it runs about 80%. They're good. It is quite likely Yaesu is the best transceiver made anywhere in the world.

Send for our free information packet that tells the Yaesu story and gives you facts, specifications and schematics for the FTdx 560. The radio you can steal.

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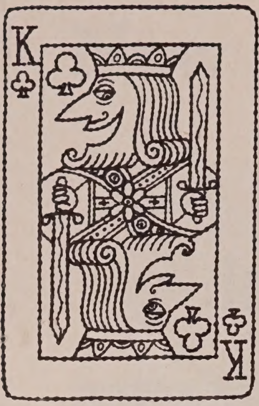

"so who's looking after the store...?"

BY SYLVIA MARGOLIS*

It hit the world headlines—newspapers, radio and TV—and held them for 10 days. It made *Time* magazine. It united three families in a way three families had never before been united. Two were ordinary families, in Pennsylvania and London. The third was an extraordinary family in a war-torn, agonised city. The extraordinary family were accustomed to publicity. It was part of their heritage, indivisible from their status and it will be theirs as long as they survive. The other two families were rocketed, overnight, from suburban nonentity to world-wide fame. None of the families can ever be quite the same again.

BBC TELEVISION
NEWS
MAX LOAD 30 cwt

The B.B.C. Outside Broadcast Television Unit takes over the QTH of G3UML and G3NMR.

It has been praised as the biggest public relations thing that ever happened to amateur radio. It's been criticised as tasteless sensationalism. It's been lauded as a demonstration of how amateur radio crosses all barriers of race, creed and class. It's been condemned as the most un-amateur radio in 50 years. It's been acclaimed as an example of man's determination to communicate. It's been dismissed as a deplorable bid for personal publicity.

Now, weeks after, in the repetitive discussions on how it happened and whether it should have happened at all, I could admit that what happened was entirely my fault and my responsibility.

Ours may be an ordinary family but by no stretch of the imagination could it be called "normal." The qualifying factors are that my husband in G3NMR: our elder son is G3-UML; I am a journalist whose whole being is conditioned by one reflex, which may be expressed in the formula: *story = news = telephone.*

So I started it all. Or did I? Whole trains of action are set off by quirks of destiny. I reached for a telephone when, perhaps, I should have kept my big trap shut. But, if Laurie hadn't failed one of his university exams; if he hadn't thus had to cut short his trip to the U.S. by two weeks, to re-sit the exam; then, on the night of September 16th, 1970, Laurie would have been on the West Coast of the U.S., with Sam Grey, W6ZJA, or Gordon Marshall, W6RR, or with Don Miller, all of whom had invited Laurie to visit them. Or Laurie could have been writing out the 2,000 or so QSL's that had accumulated whilst he was away from home, after his GC

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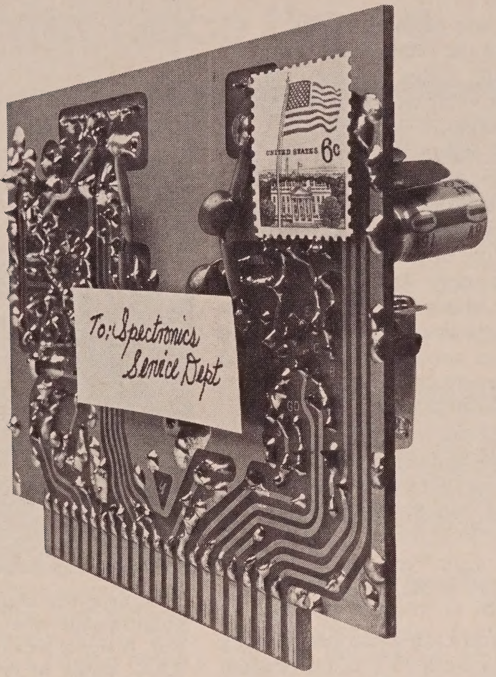
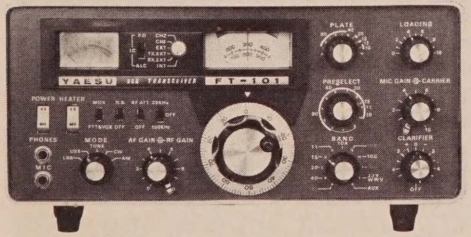
*95 Collinwood Gardens, Clayhall, Ilford, Essex, England.

Repair by mail.



Except for driver and finals, the Yaesu FT-101 is all solid state. Ten FET's, 3 IC's, 31 silicon transistors and 38 silicon diodes do the job — solidly. Most of these components are found on computer-type plug-in modules. Should one of them ever give you trouble, just send us the module. We'll send you a factory-new replacement by return mail.

But with the FT-101, you can expect everything but trouble. Like a built-in VOX, 25 KHz and 100 KHz calibrators, the WWV 10 MHz band, a high Q permeability tuned RF stage and a 5 KHz clarifier. All of that in a portable rig that sounds like it was home base.



The FT-101 is thirty pounds of power. You can work the world on 260 W PEP, 180 W CW or 80 W AM maximum input power. The world between 80 meters and 10 meters. And you'll hear it back with 0.3 microvolts sensitivity — and a 10 db signal-to-noise ratio.

This rig even includes 12 VDC and 117 VAC built-in power supplies right in the package. You supply the 12 or 117 volts plus an antenna and you're air-ready.

For in-motion operation, a noise blanker is essential. We didn't forget to include it in the FT-101. It picks out noise spikes and leaves you with nothing but clean, crisp signal copy.

Though plug-in modules mean quick, convenient repair, we don't really expect to hear from FT-101 owners. Unless it's on the air. Maybe that's why we unconditionally guarantee it for a year. The FT-101 — only $499.95.

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expedition during the *CQ* WPX Contest. Or Laurie could have been doing what Laurie should have been doing, studying for his examination.

Instead Laurie was listening on 20.

These, then, are the facts. Read them and judge for yourself. Judge whether we did right and whether what we did was good or bad for amateur radio.

A few minutes before midnight on 16th September, 1970, our elder son, Laurie, crashed into our bedroom. In normal households, where family togetherness is an established way of life, this circumstance could have signalled a cosy family chat or a thoughtful query about whether that roast chicken in the frig was a spare, because I've just eaten it, or an announcement preceded by ominous words:

"But we *were* careful . . . !"

What Laurie did say was:

"If you were a king and there was a civil war in your country and there were bullets flying around your head, would you be operating amateur radio . . . ?"

"Oh—the JY1 on again" my husband mumbled, put down his book, turned over and went to sleep.

Both Maurice and Laurie had been among the first stations to work JY1, King Hussein of Jordan, when he'd first come on the air, way back in March. It was a joke that Hussein had come back to Laurie's casual CQ and that the King, like all new-fledged amateurs, was so excited about his new toy that he sent out all his early QSL's by registered mail and filled in by hand.

I switched off the light but lay in the dark thinking about this. Then instinct and conditioning triumphed over fatigue (and discretion, maybe,) I put on the light and stretched out a hand for the phone. I called a playmate on the B.B.C. Newsdesk:

" . . . if you were a king . . . ?"

Next morning, at 6:30, two cars pulled up in our quiet, suburban street. It was a beautiful, golden, September morning and already the dog-owners were padding from tree to tree and newspaper delivery boys whistling from door to door.

Most radio amateurs' neighbors are used to seeing and hearing weird things, but the thing that was happening outside our house made the curtains flutter all down the street. Both cars bore the magic legend *B.B.C. News Radio Car* and, from the roof of one, began to arise a mobile antenna of such proportions that even our neighbors realised this wasn't just another kooky amateur radio happening, but something bigger than all of us.

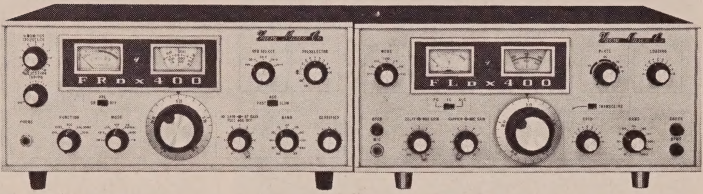
"This thing was bigger than any of us!"—the telescopic mobile antenna on the B.B.C. News Radio Car. A signal was transmitted direct back to the B.B.C. studio at Broadcasting House, 10 miles away.

To appreciate the impact of this visitation, you must understand that, although the B.B.C. shares the British television franchise with our one commercial channel, sound radio in Britain is a monopoly held by the august, majestic and immensely distinguished British Broadcasting Corporation. The standard of British radio and TV is among the highest in the world and the B.B.C. is probably the most respected communications media that exists.

The B.B.C. News Radio Car was to transmit direct back to the studio the tape that Laurie had made of King Hussein of Jordan, JY1, talking to his friends, Mary Crider, WA3HUP, and her husband, Charles. This was for an early-morning program called *Today*, similar to New York's *WINS* (all news program).

There was a bit of difficulty at first. Somebody at the studio end forgot to pull a switch and there was enough *Well, we're ready for*

Now you don't have to pay twice the price to get twice the rig.



Picture this pair in your shack. The Yaesu FLdx 400 transmitter and the FRdx 400 receiver. Loaded with power. Loaded with sensitivity. Loaded with features. Loaded with value. Read on, and discover how you can have the most up-to-date receiver-transmitter rig in the world . . . and at an unbelievably low price.

The FRdx 400 Receiver

Get a big ear on the world with complete amateur band coverage from 160 meters through 2 meters, including WWV and CB reception. Four mechanical filters do it — they provide CW, SSB, AM and FM selectivity. Separate AM-SSB-FM detectors are included, along with squelch and transmit monitor controls. Plus a noise limiter and a variable delay AGC. And a built-in notch filter with front panel adjust for notch depth.

The FRdx includes calibration markers at 100 KHz and 25 KHz, with accurate calibrator checks verified by WWV. A solid-state FET VFO for unshakable stability. And a direct-reading 1 KHz dial affords frequency read-out to less than 200 Hertz.

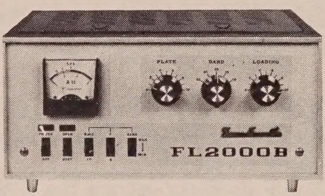
The FRdx 400 sells for $359.95.

The FLdx 400 Transmitter

Here's how to set yourself up with dual receive, transceive or split VFO operation. The FLdx 400 with its companion receiver brings you the ultimate in operational flexibility. Flexibility like frequency spotting, VOX, break-in CW, SSB, AM and even an optional FSK circuit.

The completely self-contained FLdx 400 features a built-in power supply, fully adjustable VOX, a mechanical SSB filter, metered ALC, IC and PO. A completely solid-state FET VFO provides rock-solid frequency stability.

We rate the FLdx 400 very conservatively. That rating guarantees you 240 W PEP input SSB, 120 W CW and 75 W AM. The FSK option will go all day at a continuous 75 W. And you get full frequency coverage on all amateur bands — 80 meters through 10 meters — with an optional provision for certain other bands that you can personally specify. For all that, you pay just $299.95.



FL2000 B Linear Amplifier.

Ideal companion to the Series 400, this hand-crafted linear is another example of Yaesu's unbeatable combination of high quality and low cost. Designed to operate at 1500 watts PEP SSB and 1000 watts CW, this unit provides superb regulation — achieved by a filter system with 28 UF effective capacity.

Other features include dual cooling fans (one for each tube), individual tuned input coils on each band for maximum efficiency and low distortion, and a final amplifier of the grounded grid type using two rugged carbon-plate 572 B tubes. Ready to operate at only $299.95.

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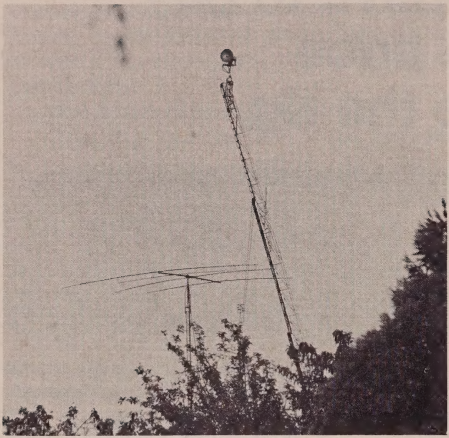

The B.B.C.'s 100 ft. dish antenna for the live television broadcast makes the G3NMR Hy-gain, at 60 ft., look pathetic!

u and *Did you go over?* and *All I can hear* *carrier* to make it sound like an amateur teor-scatter contact on 2.

The *Today* program carried the story of the London radio amateur who had heard Hussein operating amateur radio, during a vicious civil war, and calmly discussing radio conditions and setting up skeds, for all the world like a veteran W8 talking to a veteran W9 on 75.

By now all communications with Jordan were cut off. The world's newsmen were trapped, incommunicado. There was chaos and rumour and fear, for the situation had all the makings of World War III. The eyes and ears of mankind were focussed on Amman but they could see not and they could hear not. The only link with the country was through the only radio amateur in Jordon, who happened also to be its ruler.

It was a link that nobody had ever taken seriously, not on a world-wide basis. Amateur radio, particularly in Britain, got into the news only when an amateur interfered with his neighbors' TV or committed alleged similar mayhem. Now the world was making some sense out of amateur radio.

Mid-morning our phone began to ring and it didn't stop for 10 days. At one time the line was so blocked that only the international operator, announcing yet another overseas call, could break in.

Nine times that day alone I told the story, the whole *megillah,* starting from basics: "There are in the world over 400,000 licensed radio amateurs..." Experience, during the three searing years I did the honorary public relations for the Radio Society of Great Britain, taught me that, when you're telling outsiders about amateur radio, unless you *begin from the beginning and go on until the end; then stop,* as the King told Alice, then you'll waste a lot of time afterwards answering questions and going over old ground.

And that traumatic R.S.G.B. experience taught me exactly what it is in amateur radio that the Press want to know, need to know and what it's good for them to know. Even so, I still gave the newsmen information that impressed them not at all, although it was as important to me and my family as any old king in Jordan. There was this ZA, on the air at last, and my husband and my son had worked him and G3BXI had worked him mobile...

But the Press quickly channelled me back to what concerned them, that, remarkable and incredible, in the middle of a civil war, King Hussein of Jordan was taking time out not only to talk to his amateur radio friends, like the Crider's and Laurie, but grabbing a few moments to give signal reports to any other amateurs who were lucky enough to be around at the time.

Again and again they asked how the war was going. "No idea," I replied, "Wouldn't dream of asking him. This is *amateur* radio and we don't ask questions like that."

"So what are they talking about?"

"Amateur radio, exchanging signal reports and describing their equipment and setting up further radio appointments."

The London evening papers picked up the story from the B.B.C. That evening the representatives of the leading London dailies, including the *Times,* gathered in our dining room, where the rig is. The possibility that the King will be around and that we will be able to contact him give you odds of about 3 to 1 against. And you must understand that the terms of the British amateur license forbid us to talk politics, I warned them. But they came all the same.

We sat around drinking coffee and gossipping, as journalists do in the long hours of waiting. Laurie was at the rig, listening on the headphones. Somebody was telling a joke about what the News Editor said to the girl reporter, when Laurie said, quietly:

"He's on!"

And there he was! The JY1, talking again to the Crider's. Expertly timed, Laurie broke in at the precise and proper moment: "G3-UML on the frequency, Your Majesty..." (So what else can you call a king on the air?)

The tension in our home was palpable. Even these experienced, seen-it-all, top newsmen were excited. And back came the JY1! The impossible, the unbelivable, had happened.

We taped the QSO and afterwards, as the tension relaxed in a flow of Johnnie Walker *Black Label,* we played the tape over, word by word, interpreting the s.s.b. for the pressmen's uneducated ears. Something occurred then that I have never known to happen before. The reporter from the *"Daily Mirror,"* which has the largest circulation in the western world, said:

"Let's all get the same story; and let's all get it accurate!"

From our house came one of the very rare pooled news dispatches in newspaper history. The second came a day or so later, from the beleaguered journalists in Amman.

It was the amateur character of the QSO that so fascinated and bemused the Press. Even WA3HUP, Mary-Anne Crider, whose U.S. license terms are much less restricting than the British, never asked Hussein how the batle was going, never mentioned military strategy, nor need for supplies or help.

And, not possibly being able to know that the world's Press were by now listening to every word, Hussein of Jordan did more to establish and embellish his image abroad, through his impeccable *amateur radio operation* than Madison Avenue full of high-powered P.R. wizards could have done for him.

"If I hadn't heard it myself, I would never have believed it. I've never experienced anything like this in my whole career!" said the man from the *Daily Express.*

"Here we are, spending thousands on our communications systems, and we can't get a word out of Amman. And here you are, in your own home, chatting with the King as if nothing else mattered!" He shook his head, bewildered.

"Of course, the fellow was educated in Britain —Harrow and Sandhurst, you know," said the man from the *Times* and that explained a lot.

The *Today* people came back, late that night, interviewed Laurie and departed, bearing away in triumph the tape of the first JY1/G3UML contact. Another B.B.C. program did a late-night phone interview with Laurie; the *Today* item was broadcast next morning.

Live outside television broadcast from a ham-shack.

Every national newspaper bore the story on its front page, the amazing story of the "20-year-old Jewish student" to whom King Hussein had time to talk, in the midst o civil war. Not only was there the news bu there was comment of a kind we had neve before seen about amateur radio in the popular Press:

The greatest cool in history! they said of Hussein.

Amateur radio becomes respectable at last! they said of amateur radio.

Not only were the Press impressed by amateur communication, at last, but they were intrigued by the fact that Laurie, a Jew, and Hussein, an Arab monarch, spoke on equal terms, demonstrating our often-claimed, but seldom believed, maxim that in amateur radio there is no barrier of race, creed and class. Again and again, during the next overwhelming days, Laurie was asked by interviewers, on papers, radio and TV:

"How do you feel, as a Jew, about this?"

"Hussein is an excellent radio amateur," was his reply.

The only real criticism that came was from an intelligent Jewish neighbor, who greeted me one day:

"I think it's disgusting!"

"What's disgusting?" I countered, warily. I know my people tend to lose all sense of proportion when anything Jewish achieves sensational publicity.

"It's disgusting! There's that king supposed to be running a war and all he's got to do is to play with amateur radio!"

Like the story of the Jew who is dying, looks around at his sorrowing family clustered

SCOOP! The night the King came too! B.B.C. television interviewer Chris Rainbow (3rd from l.) with Laurie, G3UML, just after they had "scooped" the contact with JY1. That's a snazzy mike on the right there! With notebook is David Hopkins of the London *Daily Mail.*

round his bedside and asks:

"So who's looking after the store?"

And the Circus came to Town.

By 10 the representative of the B.B.C.'s rival, Independent Television News, who was very goodlooking indeed, was ensconced in our home and in my heart, helping out making extra coffee, paying court to our Siamese cat, Annabel, answering the phone, making appointments for us with other media and keeping a place warm for his camera team, who were on their way. So were *Radiotelevision Francaise* and C.B.S. Television News. B.B.C. Television News made an appointment for that afternoon.

At lunchtime I looked round at the dozen or so men scattered round the house, carrying out furniture and taking the doors off their hinges, which we always do when we have a party. I cracked a crate of eggs into a bowl and started whisking. Came a call from somebody who must speak to me and me alone.

"Can anybody here cook?" I yelled.

"I can," said the man from C.B.S.

"Then scramble!" I instructed.

Weeks later Bill Leonard, W2SKE, who has some small connection with C.B.S., I've been told, was in London. I complained about his cameraman.

"As a cameraman he may be superb, but he's a lousy egg-scrambler!"

Radiotelevision Francaise were so enchanted with the set-up they even interviewed Annabel, who declined to make a statement but said we were just good friends.

As the I.T.N., C.B.S. and R.T.F. teams left, the B.B.C. moved in. First came a team from the telephone company, to install a separate outside line for the B.B.C. Then there loomed down our narrow, quiet, suburban street three trucks. One was as big as a house and sprouted a telescopic dish antenna on a fire-escape, 100 ft. high, so it made our poor little 60 ft. tower look pathetic. The first time it rose they'd forgotten to attach a vital cable, so it had to come down again, like the biggest yo-yo in the world. You never did see such a wacky Field Day!

It was a quiet Friday evening, except for the traffic block caused by the B.B.C. and the stream of neighborhood cars, taking a drive past our house to see what was going on. A small, cross B.B.C. electrician dived into secret recesses of the house we didn't know existed and produced electricity we didn't know we had. The emptied dining room was filled with cameras, tracking trolleys, lights, directors, cameramen, B.B.C. interviewers, another I.T.N. reporter, (to keep an eye on the B.B.C., I guess,) and reporters again from all the major papers.

They crowded the living rooms, the hall and sat all the way up the stairs.

"Who are you?" asked a B.B.C. cameraman of a man he passed on the stairs.

"That's what I'm beginning to wonder, but I think I own this house!" replied my husband.

It was a very exciting evening, except it was Hamlet without the Prince, because the

[*Continued on page 80*]

Amateur radio has its pleasant interludes!—Laurie Margolis, G3UML, in a face-to-face interview with Sandra Harris of Today, the television Eamonn Andrews show. *(Photo by permission Thames Television.)*

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"World's Largest Distributor of Amateur Radio Equipment"

F.M.

BY GLEN E. ZOOK,* K9STH/5

THIS month marks the birth of a new column in *CQ*. The ever increasing number of amateurs interested in v.h.f. and u.h.f. f.m. operation have pointed out a need for specialized information sources. The new FM column is designed to fill this void. This is not to say that information is not available from other sources (including publications other than *CQ*) but that the information now available to the average f.m.'er is often several months old when first published. Information such as availability of equipment, changes in repeater frequencies and locations, and general questions and answers need to be as current as possible. Construction articles, modifications of equipment, and general commentaries on f.m. are necessary, but they are seldom degraded by a wait of several months before publication.

This column will cover as much ground as possible. Each month information concerning new repeaters, changed frequencies, tone coding, etc. will be given high priority. Questions will be answered if at all possible. Those questions which have a wide appeal or which are very common will be published as an aid to other amateur f.m. operators. Sources of equipment (both commercial and private) will be published when the supply is sufficient to meet the demands of a large group of amateurs. Smaller lots will be recorded and the information passed on to active f.m. groups in the areas in which the equipment is located. Each month there will be a technical section in which modifications, tune-up instructions, and similar information on specific pieces of f.m. equipment will appear.

No column can hope to do a good job without the support of those amateurs interested in that particular phase of amateur radio. This column is no exception. News items (with photographs when possible), technical tips; equipment source information, repeater location and frequency information, and even questions will be greatly appreciated. Clubs and repeater organizations should submit the name of a representative to receive information of local or regional interest. Manufacturers, suppliers, and others commercially involved in amateur f.m. should include this columnist on their mailing lists to insure proper mention of their products and/or services to the largest possible group of amateur f.m.'trs.

Thus begins the first FM Column.

Technical Talk

The first Technical Talk contains information known to many old-timers in f.m. but may be unknown or only partially known to the newcomer. The subject? How to properly tune-up obsolete commercial f.m. equipment. For all practical purposes low-band (10 and 6 meter equipment and high-band (2 meter) equipment tune up the same. U.h.f. or "450" equipment often tunes differently from the others, thus requiring specific details for each type of input. This information will be carried in a later column.

As may be expected the more specific test equipment available, the easier the job. The most basic items needed are a v.o.m. (or v.t.v.m. if a.c. is available), a signal source on the desired frequency (signal generator, crystal oscillator, *etc.);* a dummy-load; and an indicating wave meter, field strength meter, or wattmeter. Of course a deviation meter, frequency standard, and other pieces of test gear are desirable, but initial alignment can be accomplished without them.

First, proper crystals must be installed. Then the test points determined. General Electric equipment usually has pin jack points labeled for each stage. Motorola equipment (except for some types of portable and new solid state equipment) usually has an 11-pin test jack for the transmitter and for the receiver. Other manufacturers use jacks, internal meters, or specific indicated points on the circuit-board or hand wiring. In any case the v.o.m. will suffice. Usually the meter should be placed on the range with 5 v.d.c. maximum. However, certain test points may have high voltage present, so be safe and take a reading on a high scale first.

Transmitter Alignment

The transmitter is the easiest portion of f.m. equipment to align with simple equipment. Frst of all, attach a dummy load to the antenna jack of the unit. A good load can be made from several carbon resistors in parallel to produce 50 ohms at a sufficient power dissapation level. Of course a Bird Termaline Wattmeter is nice, but few f.m.'ers have $265 to spend on one. A light bulb neither presents a 50 ohm load nor makes a good non-radiating load. I have worked several miles on a #47 bulb with 1 watt output!!! Never, never, never tune up a rig on an antenna.

---

*818 Brentwood Lane, Richardson, Texas 75080.

Next, check to see if the transmitter has a tune-up position. This usually consists of a switch marked TUNE-OPERATE or HIGH-LOW. Place the switch in the TUNE or LOW position. If the unit does not have such a switch, remove the plate cap from the final amplifier tube or pull the tube from its socket. Next turn the unit on. Key the transmitter for short periods of time while tuning each stage for maximum meter readings (usually – v.d.c.). If the transmitter has been modified to cover a frequency range different from factory original (such as moving a 30-40 mc unit from 30.140 to the 6 meter amateur band 52.525 mc) each stage should be checked with a grid-dip meter to insure it is operating on the correct frequency. When the driver stage is reached, the final amplifier tube should be replaced if it has been removed.

After the driver has been tuned for maximum grid current to the final amplifier, the final is tuned for maximum output. Next place the TUNE or LOW switch in the OPERATE or HIGH position and repeak both the driver and final amplifier stages for maximum readings. If a calibrated wattmeter is available, the final should be adjusted for the output power specified by the manufacturer. Always remember that commercial f.m. equipment is rated in watts *out* rather than in the amateur standard of watts *in*. Of course the FCC regulations specify that the watts *in* be recorded, but most f.m. equipment when running maximum output are far short of the 1 kw amateur limit.

Motorola Equipment

When tuning up Motorola equipment the proper pin on the 11 pin metering jack may be determined by the following manner: The grid of the final amplifier is always pin 6. Each stage going back towards the crystal oscillator is one number less. For example, the grid of the driver is measured on pin 5. On most Motorola tube type transmitters tuning begins on 4 for low-band and 3 on high-band equipment 7 & 8 are used to measure B+ and final plate current. B+ is measured from 7 to ground and plate current is measured by calculating the voltage drop versus current through a 4 ohm resistor connected in series with the plate lead and connecting to pins 7 & 8.

Receiver Alignment

Of the two portions of the f.m. station the receiver is the more difficult to align. First of all, the high or 1st oscillator must be adjusted. Tune the oscillator coil for maximum indication (pin 6 on Motorola) and note on which side of peak the activity falls off the most. Then tune just to the other side of the peak or maximum meter indication. Turn the unit off and on several times to insure that the crystal oscillates each time. Many crystals will fail to oscillate if the circuit is tuned either to maximum or on the rapidly decreasing side of the peak. Next a signal at the low i.f. frequency must be injected (455 kc in Motorola; 290 kc in many GE). Make sure that this frequency is as exact as possible for we are going to align the discriminator circuitry. Next detune the secondary of the discriminator transformer (looks like an i.f. can) by tuning the slug to the top (or bottom as the case may be) of the can. Then meter the discriminator input or primary (5 on Motorola) and peak the primary for maximum reading. Next adjust the discriminator secondary for a zero reading in the output metering position (4 in Motorola). Make sure that the voltage will swing both positive and negative and then adjust at the zero point. Do not go back and repeak the primary even though the primary reading has decreased. Next peak each circuit in the low i.f. for maximum on either the 1st or 2nd limiter test point (positions 1 and 2 on Motorola). As the signal level increases the reading on the second limiter (2) will level off and then begin reversing, at this level the stage is in saturation. The cure is either to decrease the input signal level or go to the 1st limiter (1) test point and continue to peak. Eventually only the 1st limiter test point will be usable. After peaking the low i.f. it is necessary to inject a signal at the high i.f. Again align each stage using first the 2nd limiter and then 1st limiter positions.

The next alignment stage consists of applying a signal at the desired frequency to the input of the receiver (antenna jack). If all is well, the signal should be heard although possibly weakly. If not, the oscillator-multiplier circuits may be out of alignment or the front-end coils are tuned to a frequency far removed from the desired one. In either case a simple r.f. probe may be used to align the various stages. When aligning the multiplier stages start at the oscillator and work towards the first mixer, peaking each stage for maximum output. Since the r.f. probe may load the stage being tuned, it will be necessary to repeak the stage immediately before the one being tuned. In the case of a mistuned front-end, start at the antenna jack and work towards the first mixer, peaking each stage.

After the signal is finally heard repeak both the r.f. and mixer coils for maximum on either the 1st or 2nd limiter. If a signal generator with a calibrated attenuator is available, decrease the level until the signal can just be heard. This will tell you the minimum sensitivity in microvolts. The industry yardstick of receiver sensitivity is the 20 db quieting point. This is measured by placing a v.o.m. or v.t.v.m. in the a.c. mode and attaching it across the receiver audio output (such as the terminals on the speaker). The audio gain (VOLUME) control is adjusted to give a relative a.c. voltage reading on the meter (say 1.25 volts) with no signal to the receiver. An on-frequency signal is then applied and the reading on the a.c. voltmeter decreases as the signal level increases. When the a.c. voltmeter reading has been reduced to a level of one-tenth (0.1) of the original reading (say .125 volts) the 20 db quieting point has been reached. The sensitivity can then be read directly from the attenuator on the signal generator. Typical sensitivity for 20 db quieting for commercial f.m. equipment is 0.5 microvolts or better.

The final adjustment to the receiver must be made with a signal at the desired frequency with a known accuracy. The meter is connected to the discriminator output position (#4 Motorola and the RECEIVER FREQUENCY ADJUST ("warp" or "rubber") which may be either a small variable capacitor or the oscillator coil itself is adjusted until a zero reading is achieved. Adjust the capacitor or coil so that the signal swings on both sides of zero before setting it at the zero point.

Final Adjustments

The final adjustments consist of loading the unit to the antenna and adjustment of the transmitter frequency and deviation. The transmitter should be tuned into the antenna as it was tuned to the dummy load. Tune for maximum while staying near the manufacturers rated output level (a Bird Thruline Wattmeter is nice, but!!). The transmitter frequency may be adjusted either by the use of a good frequency standard at the desired frequency or it may be "talked on" by another amateur with a receiver on the desired frequency. In either case the TRANSMITTER FREQUENCY ADJUST circuit is adjusted for the proper frequency. The DEVIATION may be set (either to ±5 kc for narrow band or ±15 kc for wideband operation) either with a deviation meter or by ear. The former method is better, but not always possible. An amateur with a receiver of the desired bandwidth can usually help set the deviation just by listening to your signal. Just increase the AUDIO LEVEL or DEVIATION control (as the case may be) until the deviation reaches the desired level.

Test Equipment

Those amateurs with Motorola f.m. equipment are referred to the following article by the author: "Add-on FM Test Set," *73* Magazine, December 1968; pp 18-19. Therein is described a simple test set which matches the 11 pin Motorola test jacks.

Also, those interested in building a deviation meter may read "Now You Too Can Have A Deviation Meter" which appears on pp 96-97 of the August 1969 issue of *73* Magazine.

News

The crystal manufacturers love the Dallas-Fort Worth, Texas area. Of a possible 13 "split channel" (30 kc spacing, ±5 kc deviation) frequencies available for repeater operation between 146.100 and 147.000 mc 12 have been assigned. Such assignments of primary repeater input and output frequencies as well as control frequencies are coordinated through a voluntary committee known as the North Texas Repeater Organization. This group works closely with the larger Texas HF FM Society, a group which boasts state-wide membership of several hundred active amateur f.m.'ers.

Open repeaters now operating in the Dallas-Fort Worth area are as follows:

Location	Input Frequency	Output Frequency
Ft. Worth	146.160	146.760
Dallas	146.220	146.820

Dallas	146.280	146.880
Ft. Worth	146.340	146.940
Denton	146.310	146.910

All repeaters are narrowband (±5 kc).

Other open repeaters within the state of Texas are growing with leaps and bounds. Examples of these are:

Houston	146.280	146.880
Austin	146.340	146.940
Amarillo	146.340	146.940
Tyler	146.340	146.940

Repeaters are not at all confined to the state of Texas. Oklahoma spouts several excellent repeaters including the famous Tulsa repeater on 146.340/146.940 and the Oklahoma City repeater on the same frequencies. New Mexico and Arizona both have active two meter repeaters on the National frequencies of 146.340/146.940 as do many other states. With the help of the repeater organizations information on repeaters in other areas will be forth-coming.

Questions

As an aid to both the newcomer and oldtimer in solving f.m. problems this column will attempt to answer all questions concerning f.m. Those questions with maximum interest will be published. Others will receive a personal answer only. Please include s.a.s.e.

Q. What receiver is best for 2 meter repeater work?

A. There is probably no best receiver for all conditions. Local availability, price, *etc.* are all considerations which must be looked at. However, I personally favor the Motorola Sensicon "A" receiver. This receiver has an r.f. deck consisting of tuned cavities rather than the usual coil and capacitor combinations. Thus, the Sensicon "A" has a very narrow passband at the operation frequency. This receiver when coupled with a suitable shield kit consisting of a bottom plate, perforated metal cover, and filtering on power leads may be operated in the same cabinet as the repeater output transmitter with little desensing from that transmitter. This receiver was manufactured well into the 1960's for use in commercial repeaters and is still used in equipment sold as reconditioned.

Q. Recently other stations have told me that my modulation distorts. The problem does not always occur, but always comes back. What can I do?

A. There are several possibilities. If you are using a carbon granuale microphone, replacing it with either another microphone or a new cartridge hay help. Striking the microphone on your hand several times may loosen the carbon and help the problem for a time. If the microphone is at fault, replacement is the only real final cure. Also check the small capacitor across the microphone cartridge. If the microphone is not at fault check the audio circuitry in the transmitter. Replace both the audio preamp and modulator tubes. If the unit has a clipper (as do Motorola units) replace the tube, usually a 6AL5 has given many commercial techniques gray hairs in both receiver and transmitter circuits. Next check voltage readings. Finally, checks can be made with an audio oscillator and oscilloscope to determine at what point distortion occurs. Also see the following question.

Q. I am having trouble keeping my transmitter on frequency. It starts out OK, but becomes unstable as I keep operating.

A. First of all are you using a good commercial grade of crystal. Commercial crystals are manufactured to closer tolerances than the run-of-the-mill amateur types. Crystals designed to work in each type of equipment are available from International Crystal, as well as others. Do you have your crystal installed in an oven? Most commercial equipment now used on amateur f.m. was designed for oven operation. The oven keeps the crystal at an even temperature thus overriding any changes in outside temperature which will affect the stability of the crystal. If the crystal is installed in an oven, the thermostat may be defective, thus allowing the temperature to increase above the desired level. Or, the thermostat by not allowing the oven to heat at all. Both cases can cause the problem, but the overheating is more likely. Ovens run hot naturally (85 degrees Centigrade for a Motorola Gold Colored oven), but a quick look inside will show any discoloration due to overheating. Other possibilities include defective oscillator tube and associated components.

Q. What is this "PL" I keep hearing about?

A. "PL" or "Private Line" is the Motorola Trade mark for its type of continuous tone squelch. Other trade names for the same thing are Channel Guard by General Electric and Quiet Channel by RCA. All work on the same principle: A low frequency audio tone

[*Continued on page 82*]

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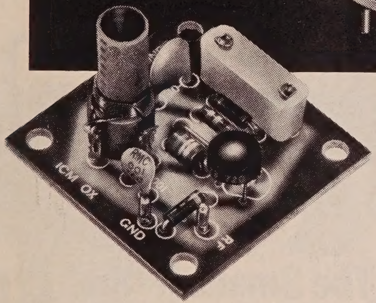

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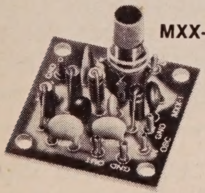

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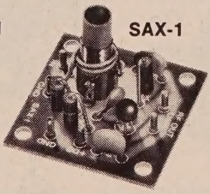

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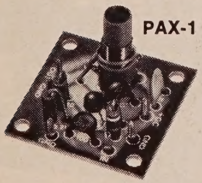

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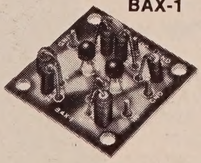

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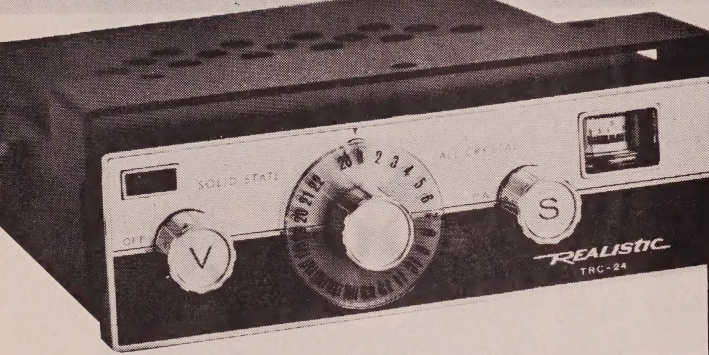

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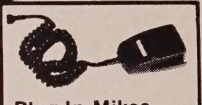

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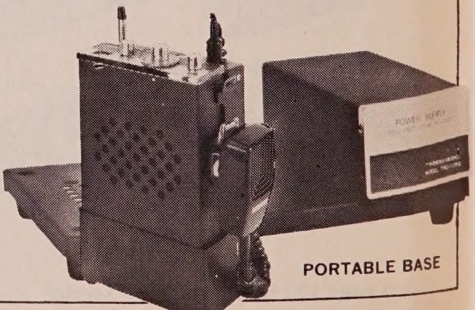

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CRYSTAL CALIBRATORS

HOW SOLID IS A ROCK?

BY JOSEPH P. FINCUTTER,* K3STU

The crystal calibrator, in one form or another, is a part of practically every amateur station, but the trust put in these simple devices often far outweighs their accuracy. Understanding how to calibrate the calibrator and how to interpret their indications will give firm basis to that trust.

WHAT is a crystal calibrator? Well, to some it is not much more than a switch on a front panel of a receiver or a transceiver that provides marker frequencies across the amateur bands, 100 kilocycles apart. It is used to identify band edges, to correct dial readings, etc., and, therefore, a basis upon which to argue about the "absolute" frequency being used. These general statements are true but considerably more knowledge about crystal calibrators is necessary to really understand what it is, how it works, and how it should be calibrated—at regular intervals.

Unfortunately (or fortunately as the case may be) my experience of the past several years as an Official Observer for the ARRL has brought me in contact with many "delusions" about the use and/or need for crystal calibrators. For example, one of the most frequent cases of misunderstanding is that since the frequency is generated by a 100 kc piezo-electric crystal, it is always "on frequency,"—"solid as a rock!" So I ask why the manufacturer puts an adjustable component in the circuit if it never needs adjustment. It is amazing to find out how many amateurs don't know that there is an adjustment (calibration) that must be made from time to time in order to have an accurate 100 kc signal. Therefore it seems that a little explanation of the crystal calibrator is in order.

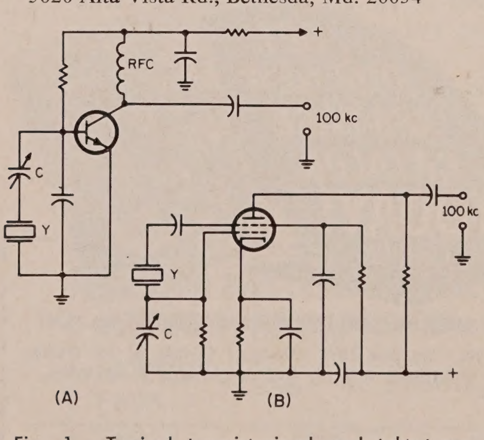

Fig. 1 — Typical transistorized and tube-type crystal calibrators. In each case capacitor C is used to "pull" the frequency of crystal Y.

Basically the crystal calibrator consists of an oscillator whose frequency is controlled by a piezo-electric crystal. The crystals are usually of a high order of accuracy, such as ±0.005%, or better and are fairly insensitive to small temperature changes. You get what you pay for in a good crystal; the less expensive are not always too stable; the more expensive are enclosed in a temperature controlled oven and provide a higher order of accuracy and stability. The types found in most commercial amateur equipment are reasonably accurate and stable, but they do require periodic calibration.

Calibrator Frequencies

What is the basic oscillator frequency? We usually speak of the "100 kc Calibrator" but this is not always true. For the v.h.f. and/or u.h.f. spectrum, oscillators at 10 mc and 5 mc are not uncommon. For the h.f. spectrum the basic frequency starts at 100 kc. I used

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*5620 Alta Vista Rd., Bethesda, Md. 20034 "starts at" because incentive licensing introduced those sub-bands within which certain licensees must operate. And to properly locate these bands, markers at 25 kc intervals are necessary. So we must "divide" the 100 kc down to 25 kc by additional circuitry. It might be well to mention here that there is another type of calibrator called a Marker Oscillator or Generator. (Semantics can be bothersome at this point because we're naming a circuit based upon its use and not upon its electronic circuitry.) Usually this generator consists of an oscillator using a number of selectable crystals that will provide band edge identification in the spectrum of amateur frequencies. In other words crystals are used to generate frequencies at 3.5, 4.0, 7.0, 7.3, 14.0, 14.35 mc, etc.

Calibrator Circuits

From that background, let's look at a simple circuit of a crystal calibrator that generates 100 kc signals, fig. 1. The modern day technology gives us a transistorized circuit in fig. 1(A) and a tube type circuit is shown in fig. 1(B). In either case the existence of a variable capacitor as a means of adjustment (calibration) of the oscillator indicates the need for a periodic check of the accuracy of the oscillator against some known standard of frequency. Either of these oscillators will generate usable harmonics every 100 kc, up to approximately 50 mc.

Figure 2 is a block diagram of a complex crystal calibrator in which the basic oscillator frequency is fed to a series of frequency divider circuits to produce outputs at 100 kc, 50 kc, 25 kc, 10 kc, 5 kc and 1 kc. The advent of economical transistors and integrated circuits which operate at low voltages and low currents make these solid state devices ideal for use in a calibrator. No attempts will be made in this article to provide circuitry or constructional details because all of the amateur magazines and handbooks have provided a wealth of these types of circuits over the years. I have included a bibliography which covers approximately the last 2½ years, taken from *QST*, *73*, *CQ* and *HR*. I'm sure that this list is not complete but it does show the importance placed on crystal calibrators and on good frequency measurement. Again, numerous manufacturers[1] offer kits and complete ready-to-operate calibrators at very reasonable prices.

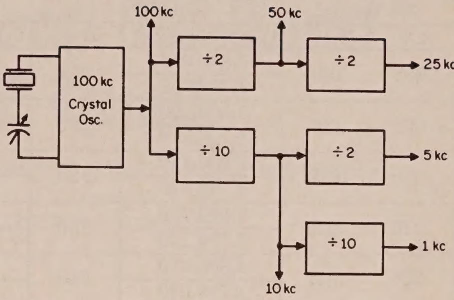

Fig. 2—Crystal controlled calibrator/frequency standard.

Adjustment Accuracy

How do we tune or calibrate a crystal calibrator? Calibration means adjustment to some standard of reference. Well, the best frequency standards are the standard frequency transmissions from the National Bureau of Standards, WWV and WWVH, on 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 mc. Therefore you need a receiver capable of being tuned to at least one of these frequencies. Although any one would be usable, it would be better practice to use the highest frequency receivable so that you would be using a high order harmonic of the 100 kc oscillator. For example you would be using the 150th hasmonic of 100 kc when you compare it with 15.0 mc, the 100th with 10.0 mc, the 50th with 5.0 mc, etc. The procedure of comparing the calibrator with WWV through the receiver is know as "zero-beating" wherein you use the receiver as a null indicator to indicate zero difference between the harmonic of the crystal and the transmitted frequency from WWV. One point to remember is that as you approach zero-beat the audio frequency (difference frequency) becomes lower and lower. But what is the lowest frequency that the audio system in your receiver will pass? Usually it will not be much lower than about 20 c.p.s., even if it sounds lower than that. Is this an accuracy problem? Yes and no! Let's examine this answer. Suppose that the lowest audio frequency passed by the

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[1] Manufacturers of crystal calibrators:
Digi-Key, Box 27146, Minneapolis, Minn., 55427
Lab 1, The Radio Shop, 48 Elm Street, New Canaan, Conn., 06840
Stafford Electronics, 427 S. Benbow Road, Greensboro, N.C., 24701
Heath Company, Benton Harbor, Mich., 49022
International Crystal Mfg. Co., Inc., 10 N. Lee, Okla. City, Okla., 73102

100 kc Xtal		3,800 kc		7,200 kc		14,200 kc	
± %	± kc	Frequency	± kc	Frequency	± kc	Frequency	± kc
.001	.001	3,800.038	.038	7,200.072	.072	14,200.142	.142
		3,799.962		7,199.928		14,199.858	
.005	.005	3,800.190	.190	7,200.360	.360	14,200.710	.710
		3,799.810		7,199.640		14,199.290	
.010	.010	3,800.380	.380	7,200.720	.720	14,201.420	1.420
		3,799.620		7,199.280		14,198.580	
.020	.020	3,800.760	.760	7,201.440	1.440	14,202.840	2.840
		3,799.240		7,198.560		14,197.160	
.025	.025	3,800.950	.950	7,201.800	1.800	14,203.550	3.550
		3,799.050		7,198.200		14,196.450	

Table I—100 kc crystal accuracy versus harmonic relationships.

audio system is 20 c.p.s., and you adjust the calibrator to *zero-beat*. How close to 100 kc is the crystal circuit? Well, if we beat the crystal against a 15.0 mc received signal, the crystal would be oscillating at 100 kc, ±0.33 c.p.s. (±1.33 parts per million); at 10 mc, it would be oscillating at 100 kc, ±0.2 c.p.s. (±2 p.p.m.), etc. Even at 5 mc the accuracy is ±4 p.p.m. In all cases, even though the accuracy would increase as we used higher frequencies, almost any known reliable standard frequency transmission above 5 mc. could be used and we could operate with a reasonable degree of confidence that we were within the amateur bands.

Useful Accuracies

Table I is a compilation of data to give you some idea of basic crystal accuracies (and /or adjustment accuracies) in terms of the useful harmonics of 100 kc in the 80, 40 and 20 meter bands. For example, a crystal oscillator that is adjusted to ±1 c.p.s. at 100 kc will give you an accuracy of ±142 c.p.c. at 14.2 mc, assuming that you can in reality "zero-beat" the signal at 14.2 mc, again limited by the audio frequency of the receiver. On the other hand, if the crystal calibrator is adjusted to within ±25 c.p.s. at 100 kc, then the harmonic at 14.2 mc would be within only ±3.55 kc. So to be on the safe side, you would necessarily have to operate approximately 4 kc above the low end of the band and 4 kc below the high end of the band to be sure that you were "inside the band." Simple mathematics indicates that the higher the harmonic that is used, the greater the inaccuracy of measurement. However, this mathematics problem can be reduced by adjusting the 100 kc oscillator frequency to the highest possible accurate frequency, such as 15 or 20 mc. The error in measurement at 15 mc would be divided by the harmonic number, thus making the error at 100 kc very, very small. A few cycles at 15 mc, divided by 150, is only a fraction of a cycle at 100 kc.

Crystal accuracies, as specified by the manufacturer, are limited to input impedance characteristics (and others in some cases) of the circuit in which it is used, environmental conditions, etc. So adjustment to the nominal frequency is required in all cases. And a periodic adjustment is required to keep the crystal on the proper frequency at all times.

Paragraph 97.75 of Part 97 of Volume VI of the Federal Communications Commission Rules and Regulations requires that "the licensee of an amateur station shall provide for measurement of the emitted carrier frequency or frequencies and shall establish procedure for making such measurement regularly. The measurement shall be made... by means independent of the means used to control the radio frequencies generated by the transmitting apparatus and shall be of sufficient accuracy to assure operation within the amateur frequency band used." An accurate crystal calibrator will satisfy this requirement of the law, particularly when band edges and sub-bands can be easily identified by the use of dividers to generate signals at 50, 25 kc, etc. So let's keep that crystal calibrator calibrated to the transmissions of WWV or other transmission of known accuracy. ■

Bibliography

"Crystal Calibrator and Receiver in One Box"
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"An Inexpensive Precise Crystal Oven"
Pearson, p. 33, *QST*, July 1969
"A Band Spotter and W1AW Marker"
McCoy, p. 28, *QST*, Mar. 1969

[*Continued on page 84*]

The Mono-Loop Tri-Band Cubical Quad

Operating principles and two-element quad construction details.

BY HANS F. RUCKERT,* VK2AOU

It is well known that a yagi beam does not radiate with its main lobe low enough to show its full capability unless the beam is about 70 feet high. However, we can observe that many DX stations put out very competitive signals using two-element quads at about 30 feet. The quad evidently offers a great deal of performance for a small cash investment.

On the negative side, examine the case of the amateur who showed the XYL a full-sized triband quad to test her reaction prior to starting a similar project himself. Her reaction: "You can have the quad, but I move out if you dare put such a monster on the roof." Those of us who must ask permission from such local authorities as wives, neighbors, etc. are thus seldom among the "big antenna" boys. In short, most amateurs will have to content themselves with compromise antennas, so the obvious question is, "Which design offers the best compromise?" Construction should be possible with little or no outside help, should entail the use of readily available materials, and should not wind up on the neighbor's roof next winter.

The Mono-Loop Tri-Band Cubical Quad satisfies all the criteria outlined above.

Quad Design

The antenna consists of a two-element quad measuring only 14 feet on a side. It presents about half the wind resistance of a full size three band quad by virtue of the single loop quad elements. Smaller or larger elements may also be used, with corresponding gain or loss in efficiency, but the 14 foot size is optimum.

The single loop element is tuned to three band frequencies, for example, 14.15, 21.3 and 28.6 mc. Other operating frequencies are possible with proper loop dimensions and tuning. The key to the three band operation is the three-frequency tuned circuit. Figure 1 shows two versions of this circuit, consisting of either two parallel and one series-tuned circuit, or two series and one parallel-tuned circuit. In either case, the resonant frequency of each element tuned circuit is interdependent upon the values of the other two circuits. The tuned circuit elements are not necessarily

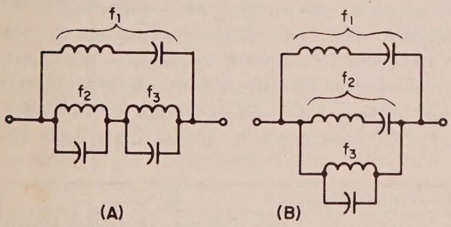
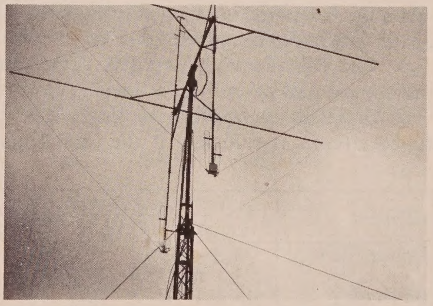


Fig. 1—Two versions of VK2AOU's three-frequency tuned circuit. F_1: self-resonant between medium frequency band and 80% of low frequency band. F_2: self-resonant between highest frequency band and medium frequency band. F_3: self resonant between medium frequency band and low frequency band.



Close-up of tuned circuits in the Mono-Loop Tri-Band Cubical Quad. Note the struts bracing each quad element to the boom. The quad elements measure 14′ on a side. The boom is 8′6″ long.

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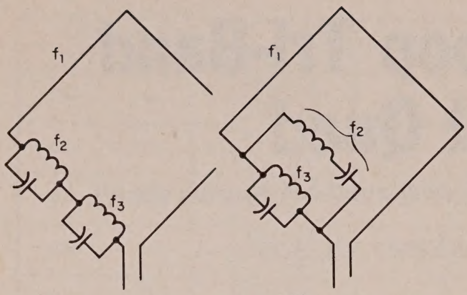
*25 Berielle Rd., Beverly Hills, NSW 2209, Australia.



(A) (B)

Fig. 2—Substituting a quad element for tuned circuits F_1 in fig. 1 yields these two tri-band quad elements. Exact placement of tuned circuits in quad element is not critical.

resonant at any of the three desired frequencies, but rather, the entire network is resonant at all three operating frequencies.

Replacing a series-tuned circuit with an antenna (dipole, ground plane, yagi element or quad element) in no way alters the characteristics of the three-band tuned circuits. In the quad configuration, the circuits of fig. 1 become those of fig. 2, with the distributed *L* and *C* of the quad element forming the third tuned circuit. The circuit of fig. 2(A) is used in the Mono Loop Tri-Band Cubical Quad.

Such an approach to three band antenna operation has been known to the author since 1958 and offers the following characteristics:

1. Operating frequencies may be within a range of from 1.6 to 1 up to 3 to 1.
2. It is not necessary for a harmonic relationship to exist between the operating frequencies.
3. The antenna is unresponsive to harmonics of the operating frequencies (except when the harmonic is practically equal to one of the three operating frequencies).
4. The full element length is active and radiating on all operating frequencies.
5. In quad applications, a single pair of tuned circuits is sufficient if the total length of the quad element does not exceed 1.5 times the highest operating frequency. For larger quad elements, two pairs of tuned circuits per element may be necessary to avoid tuning difficulties on the highest band.

The position of the tuned circuits in the quad element appears to be of no significance. In use, tuned circuit components do not even get warm, suggesting that they are not causing appreciable power loss.

Since the total element length is in excess of 1.5 λ on 10 meters, two pairs of tuned circuits per element are used. The tuned circuits are made up from small double cup adjustable ceramic capacitors or RG-8/U coax capacitors and hairpin loops of #16 wire. The total length of wire in each quad element, plus the wire length in the four hairpin loop inductors nearly equals a wavelength at the lowest operating frequency.

Construction

Quad construction is straightforward. Element spacing of 8 feet is maintained on an 8′6″ length of 2″ dia., 1/8″ wall hard aluminum boom. Element spreaders are built up by telescoping two 4′ ends of 3/4″ o.d. hard aluminum tubing inside a 12′ length of 7/8″ o.d. tubing, 1/16″ wall. The insulating tips are 10″ lengths of 3/4″ i.d. PVC tubing, heated at one end, flattened and drilled to accept wire. The total spreader length to the wire holes is 20′2″. Spreaders are fastened to the boom at 90° angles to each other with U-bolts and clamps. Struts to the boom are used as shown in the photo to secure the quad elements at right angles to the boom.

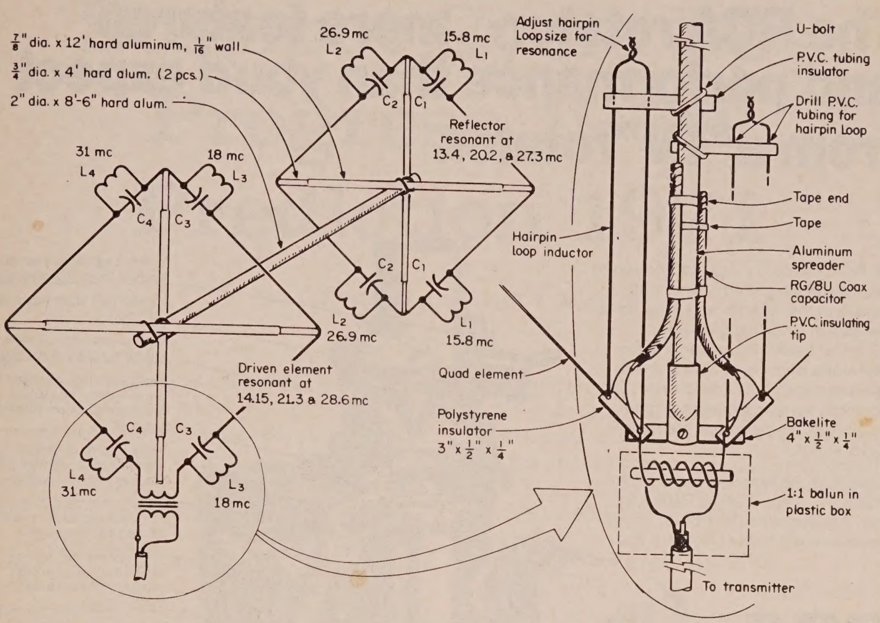
The tuned circuits are placed in series with the quad elements by simply bridging them across polystyrene insulating links. Hairpin loops are constructed of #14 wire to the dimensions shown, and are supported by 5″ lengths of PVC tubing clamped to the spreaders. If ceramic capacitors are used, they should be covered by suitable plastic pill bottles, with 1/8″ breather holes drilled at their lowest point. If the capacitors are

Element	*Resonant Frequencies*	
	Large Hairpin	*Small Hairpin*
Driver Element	18, 14.15, 21.3 mc	31, 21.3, 28.6 mc
Reflector	15.8, 13.43, 20.20 mc	26.9, 20.20, 27.30 mc

Table I—Resonant frequencies found at large and small hairpin loops of driver element and reflector.

Operating Band	*Adjust:*
20 m	Large hairpin loop wire length or quad loop wire length.
15 m	Capacitor at large hairpin loop, or small hairpin loop wire length.
10 m	Capacitor at small hairpin loop.

Table II—Tuning chart for Mono-Loop quad elements. Lengthening loops or increasing capacity lowers resonant frequency.



7/8" dia. x 12' hard aluminum, 1/16" wall
3/4" dia. x 4' hard alum. (2 pcs.)
2" dia. x 8'-6" hard alum.
26.9 mc
L2
15.8 mc
L1
C2
C1
Adjust hairpin Loop size for resonance
U-bolt
P.V.C. tubing insulator
Drill P.V.C. tubing for hairpin Loop
Reflector resonant at 13.4, 20.2, & 27.3 mc
31 mc
L4
18 mc
L3
C4
C3
Tape end
Tape
Aluminum spreader
RG/8U Coax capacitor
P.V.C. insulating tip
Hairpin loop inductor
C2
C1
L2
26.9 mc
L1
15.8 mc
Driven element resonant at 14.15, 21.3 & 28.6 mc
Quad element
Polystyrene insulator 3" x 1/2" x 1/4"
Bakelite 4" x 1/2" x 1/4"
C4
C3
L4
31 mc
L3
18 mc
C
1:1 balun in plastic box
To transmitter

Fig. 3—Construction of the Mono-Loop Tri-Band Cubical Quad. Tuned circuit values are shown in Table III.

constructed of coax, they should be taped to the spreaders. The cable capacitor braid should be connected to the lowest voltage point (transformer or connecting wire). Remove braid from about 1″ of coax at each end to ensure insulation, and tape both ends. Lengths of cable capacitors may be calculated from: 1 foot RG-8/U = 29.5 mmf or 1 cm RG-8/U = 0.97 mmf.

Driven element feed is through a 1:1 transformer from 50 ohm coax. Triple gamma matching may also be used if the tuned circuits are moved to the side quad corners. The transformer used is bifilar wound, 9 turns on primary and secondary, of #16 enameled wire, on a Q2 Ferrite rod 1/2″ dia. and 3″ long. The completed transformer is mounted in a small plastic box fitted with a coax connector for the feedline.

Tuning

If the quad elements are constructed carefully as described, very little fine tuning should be required. If other dimensions are used or if desired for "peaking," the following method (originally used by the author) may be used:

Each quad element is assembled individually, and placed horizontally atop a 5-6′ wooden step ladder so that all element parts are within easy reach.

Calibrate a transistorized GDO using the station receiver, and mark the desired operating frequencies, but subtract 3-4% because the element will have less capacity to ground when standing vertically and still less when in position 60′ in the air. With the GDO near the rounded center of the hairpin loops, check the resonant frequencies present. Three should be found: one of the hairpin loop itself (not an operating frequency) and two operating frequencies. The center band (21 mc) is found at both loops while the 28 mc

[*Continued on page 85*]

*Loop wire length**	*Capacitance*
L_1—5′9″	C_1—56 mmf
L_2—4′4″	C_2—26 mmf
L_3—4′9″	C_3—53 mmf
L_4—3′6″	C_4—23 mmf

*Figures are length of wire in loop; wire for connections is extra. Hairpin width is 2″.

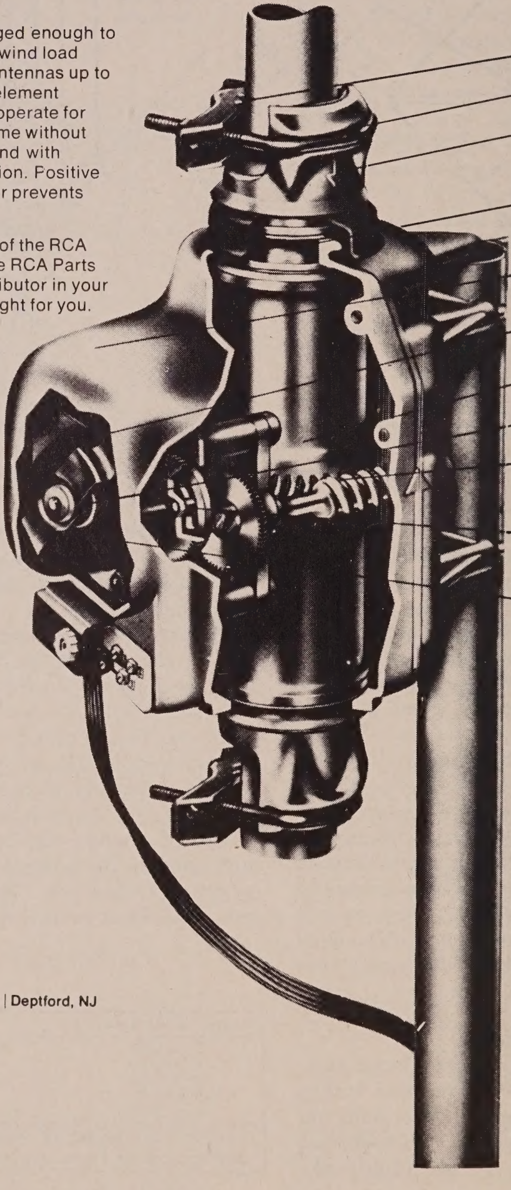
Table III—Tuned circuit parameters.

The RCA rotator...more features and performance than you'd expect from a "TV" rotator.

An RCA rotator is rugged enough to handle the weight and wind load requirements of ham antennas up to the size of a normal 3-element 20-meter beam. It can operate for sustained periods of time without thermal overload . . . and with absolute synchronization. Positive disc break on the motor prevents "overshoot."

Check all the features of the RCA Rotator . . . see it at the RCA Parts and Accessories Distributor in your area. It might be just right for you.

RCA
Rotators



V-block serrated clamping system locks mast securely.

Reinforced shaft has nested "U" bolt.

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Stainless steel bearings are permanently lubricated. No external thrust bearings required.

High-tensile aluminum housing is rugged, lightweight for less inertial loading on mast.

High-temperature insulation on motor allows continuous operation.

Main drive gear is cast integral to main shaft; can't loosen.

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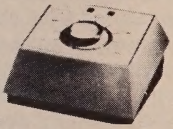

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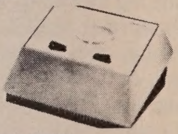
The RCA fully automatic Rotator has solid state circuitry for positive synchronization. Positive directional indicator lights. Silent operation.



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RCA | Parts and Accessories | Deptford, NJ

Sunspot Cycle 20–Progress 1970: Prediction 1971

BY GEORGE JACOBS,* W3ASK

THE present sunspot cycle has established a new record—it has stood still for 12-months!

According to the latest available solar data, the cycle hovered at the 106 mark, plus or minus 1, between April, 1969 and March, 1970. While year-long plateaus in solar activity are not too uncommon, in the past they have always occurred at considerably lower levels of sunspot activity. For example, the longest plateau on record took place during cycle 5, when the solar index remained in the 40's from January 1802 through mid-1805.

Between December 1827 and April 1829, a cycle remained practically constant at 62, and more recently a plateau occurred between November 1926 and December, 1927, when solar activity remained at the 70 mark, plus or minus 2.

Only once previously has a year-long plateau occurred at a relatively high level of solar activity, and that was nearly 100 years ago. During cycle 11, solar index of 100, plus or minus 2, was recorded for most of 1872.

The plateau in the present cycle, centered on a smoothed sunspot number of 106, has lasted for at least a 12-month period, and may extend further. This makes it the longest plateau ever recorded at such a high level of solar activity.

Cycle 20, the present sunspot cycle, began during October, 1964 with a smoothed sunspot number of 9.6. It appears to have reached its peak during November, 1968 with a number of 111. The course of the present cycle is shown graphically in Fig. 1, while the actual values of smoothed sunspot numbers are given in Table 1.

The decline of Cycle 20 began during December, 1968, reaching a value of 106 by April, 1969. Up to this point the decline was proceeding right on schedule, based on predictions developed from the behavior of the previous 19 cycles. Then the decline ended, and the plateau began. By the end of 1969 the cycle stood at an index of 105 instead of at the predicted level of 97.

Progress 1970

Solar activity during 1970 was significantly *higher* than expected. Based on statistics derived from previous cycles, 1970 should have begun with a solar level of 95 and ended with an index of 76.[1] While data is available for only the first three months of 1970, it appears

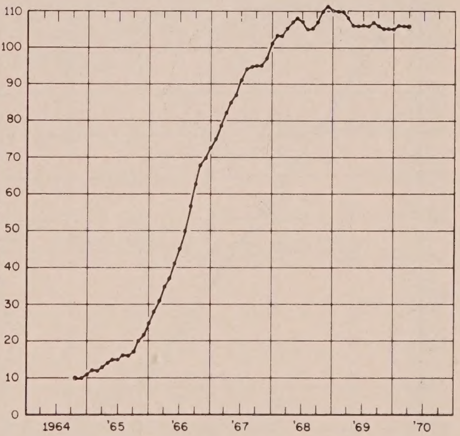

Fig. 1—Progress of Sunspot Cycle 20, October, 1964 through March, 1970. At A, the start of Cycle 20, the smoothed sunspot number was 9.6. The peak of Cycle 20 occurred November, 1968, with a smoothed sunspot number of 111. The latest value shown at C is 106 for March, 1970.

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*11307 Clara Street, Silver Spring, Md. 20902

[1] For a more detailed discussion of solar cycles, and methods for predicting solar activity see, "A Sunspot Cycle-Cycle 20; The Declining Years", Jacobs, G. and Leinwoll, S. *CQ* Nov. 1969, p. 44.

Table I

Values of smoothed sunspot numbers observed during Cycle 20. Italic figures indicate values predicted for the remainder of the cycle.

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Jan.	—	12	28	75	103	110	106	*(91)*	*(66)*	*(42)*	*(21)*	*(12)*
Feb.	—	12	31	79	103	110	106	*(88)*	*(64)*	*(40)*	*(20)*	*(11)*
Mar.	—	13	35	82	105	108	106	*(86)*	*(62)*	*(38)*	*(20)*	*(10)*
Apr.	—	14	37	85	107	106	*(106)*	*(84)*	*(60)*	*(36)*	*(19)*	*(9)*
May	—	15	41	87	108	106	*(106)*	*(82)*	*(58)*	*(34)*	*(18)*	*(9)*
Jun.	—	15	45	91	107	106	*(105)*	*(80)*	*(56)*	*(32)*	*(17)*	*(8)*
Jul.	—	16	50	94	105	106	*(103)*	*(78)*	*(54)*	*(30)*	*(17)*	*(8)*
Aug.	—	16	57	95	105	107	*(101)*	*(76)*	*(52)*	*(28)*	*(16)*	*(7)*
Sep.	—	17	63	95	107	106	*(99)*	*(74)*	*(50)*	*(26)*	*(15)*	—
Oct.	9.6	20	68	95	110	105	*(97)*	*(72)*	*(48)*	*(24)*	*(14)*	—
Nov.	10	22	70	97	111	105	*(95)*	*(70)*	*(46)*	*(23)*	*(13)*	—
Dec.	11	25	73	101	110	105	*(93)*	*(16)*	*(44)*	*(22)*	*(13)*	—

almost certain that the actual level of solar activity exceeded these values by approximately 20%.

A smoothed sunspot number of 106 was recorded for each of the first three months of 1970. It will be at least another six months before the smoothed sunspot numbers can be calculated for the remainder of 1970, but empirical data indicates that the plateau may have ended during June, 1970, with the cycle resuming its slow decline. At year's end the solar index is estimated to have been at least 93.

The plateau, which lasted through much of 1970, unexpectedly added an extra year of high solar activity to the present cycle. It also resulted in the continuation of the excellent h.f. propagation conditions observed during 1968 and 1969.

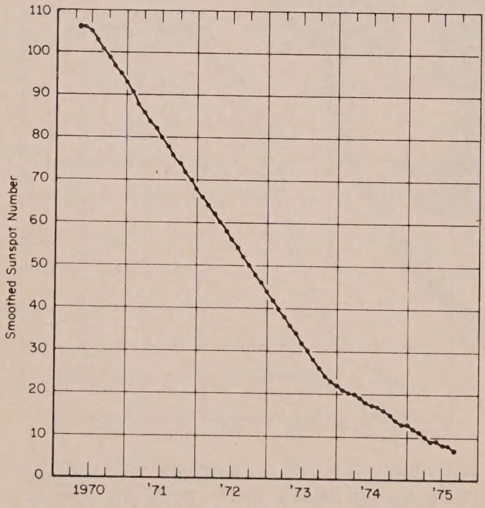

Fig. 2—Prediction for the remainder of Sunspot cycle minimum is expected to occur by August, 1975. During 1971, the solar index is expected to range from 91 to 68.

The 10 meter band continued in full bloom during 1970. Excellent DX openings took place to almost every corner of the world during the daylight hours of all but the summer months. Excellent world-wide openings were also observed on 15 meters, from shortly after sunrise through the early evening hours, throughout almost the entire year.

During 1970, 20 meters continued to be an around-the-clock DX band, with excellent openings possible at almost any hour. During the hours of darkness good DX conditions were observed on 40 and 80 meters throughout most of the year. Some good 160 meter openings were also recorded during the hours of darkness and the sunrise period of the winter, spring and fall months.

Without any question, 1970 will go down as another good year for h.f. radio propagation conditions.

Prediction 1971

While not yet positive, there are some indications that the present cycle is again on the decline. The new year is expected to begin at a solar level of at least 91, and by the end of the year the cycle will probably have declined to a level of 68. This range falls into the category of *moderately high* solar activity.

Beyond 1971, the cycle is expected to continue its decline until a minimum value is reached, probably by August, 1975. The predicted decline of Cycle 20 is shown in fig. 2, and also by italics in Table 1.

While some changes in h.f. propagation patterns may be noticeable during the new

[*Continued on page 85*]

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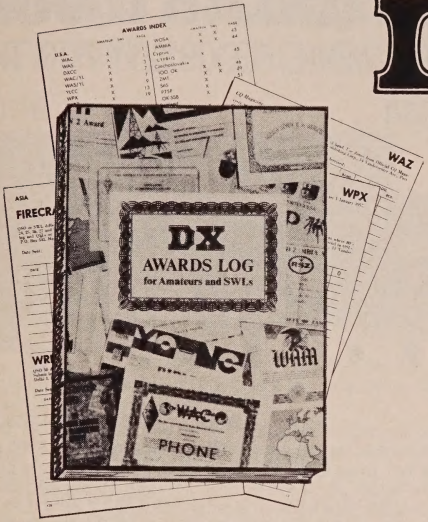

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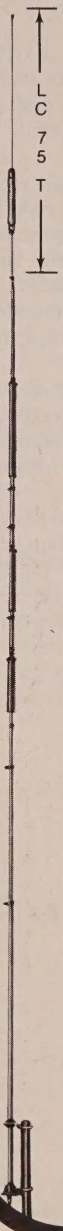

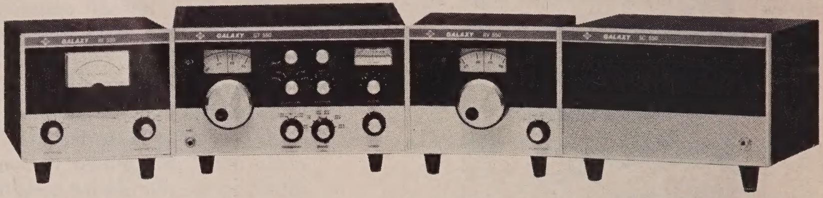

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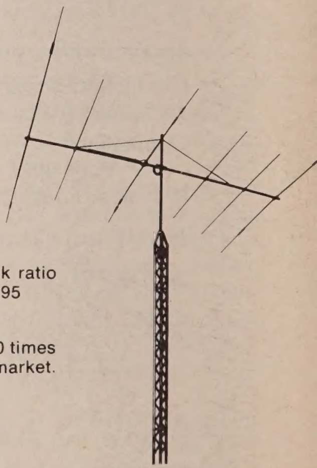

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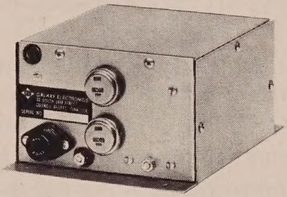

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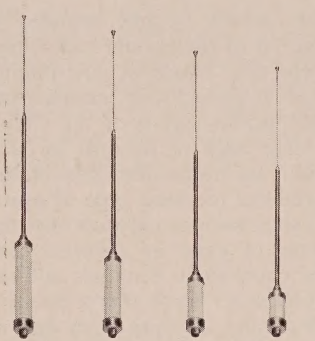

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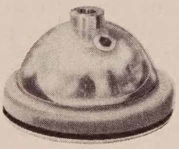

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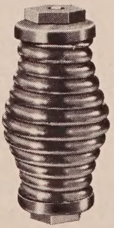

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AN AURAL DIODE/ TRANSISTOR TESTER

BY JOHN J. SCHULTZ,* W2EEY

Glancing at a meter as one tests a series of semiconductors is often annoying, especially since only an indication is desired of whether the resistance measured is relatively low or high. This tester provides a simple aural indication of resistance values so one can concentrate on the components being measured without the interruption of having to examine a meter scale every time a test connection is changed.

THE author recently became involved in testing a large lot of diodes and transistors. The tests were only aimed at determining whether these semiconductor components were basically usable—that is, if the diodes exhibited a large ratio of forward to back resistance and if the proper terminals on the transistors exhibited the same type of resistance ratio. It soon became apparent that the usual technique of using an ohmeter connected to the component terminals and reversing the ohmmeter leads (for a polarity change) while having to glance every time at the ohmmeter scale was a very unsatisfactory procedure. As one glanced at the scale reading, the test connections might become disengaged and one tended to lose his place in the sequence followed for testing a transistor's emitter-base and base-collector junction.

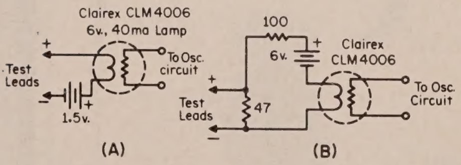

Fig. 1—(A) Direct use of battery in lamp-photocell unit and (B) use with bias network to shorten response time and decrease short-circuit current at test points.

The idea therefore developed to construct a tester that would provide an aural indication of gross resistance values. Such an instrument was not unknown as various types of aural multimeters have been developed for blind amateurs. However, the idea in this case was not to develop any sort of sophisticated aural resistance indicator, but only a simple tester that would clearly indicate the difference between a low and high resistance reading through a semiconductor junction. As it turned out, the technique developed presents the basis for further development of a more sophisticated test instrument, and, also in most cases, allows the "in-circuit" testing of most semiconductor devices because of the instrument's low shunt resistance.

The basic idea of an "aural" ohmmeter is simple. One has to have a tone oscillator where the frequency can be varied by changing a resistance element. The "resistive" element can be considered as being external to the oscillator circuit (actually the resistive device under test). However, it is rarely possible to simply remove a resistive element from one oscillator circuit and take the leads to such an element as external test leads. This cannot be done because of the voltage and current restriction that must be observed when testing a wide range of semiconductor devices. Generally, both the maximum current through a forward biased semiconductor junction and the maximum voltage across a

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*1829 Cornelia St., Brooklyn, New York 11227

reverse biased semiconductor junction must be held within relatively narrow ranges to avoid damage to the device under test.

In developing a suitable test instrument, the author at first considered various semiconductor low-voltage constant-current drive circuits that would translate changes in terminal voltage conditions to output impedance level changes. Although various circuits of such a type can be developed, it was finally decided to use a simple lamp-photocell module as the sensing element in the aural ohmmeter circuit. The final circuit that evolved is very simple and uses a minimum number of components.

Lamp-Photocell Unit

When testing a semiconductor device, as mentioned before, forward current and reverse voltage are important. Both must be limited in order to prevent damage to a semiconductor junction. A simple low-voltage lamp-photocell unit, as shown in fig. 1(A) can provide the desired combination of electrical properties. When used in series with a 1.5 v. battery, the lamp unit of fig. 1(A) produces a maximum short-circuit current across directly shorted leads of only 10 ma. The maximum open-circuit test voltage is, of course, 1.5 volts. The resistance change produced in the photocell unit when going from a short-circuit to an open circuit depends, of course, upon the lamp-photocell module used. In the case of the Clairex unit, it is about 5K ohm to 1 megohm.

While such a change in resistance is fairly broad, it does occur somewhat slowly because of the time required for the lamp filament to react at low voltage levels. Also, the 10 ma short-circuit current might prove excessive for very low-level signal diodes or transistor junctions. A variation upon the basic lamp-photocell module circuit is shown in fig. 1(B). A higher voltage battery is used but series resistors limit the current flow to a nominal value of 20 ma. When the test leads, connected across the 47 ohm resistor, are shorted the current flow increases to only 24 ma. However, the lamp-photocell unit in this condition is operating at a point where small lamp current changes produce *rapid* responses on the photocell unit resistance, although over a somewhat narrower resistance range—100K to 10K. Nonetheless, the resistance is more than sufficient, as discussed later, to produce a wide change in the frequency of an oscillator. Besides more rapid response (because the lamp element is already half ignited), the use of the circuit of fig. 1(B) produces a smaller current flow in the circuit under test (0-4 ma from open to short-circuit) and only a maximum open circuit voltage of 1 volt.

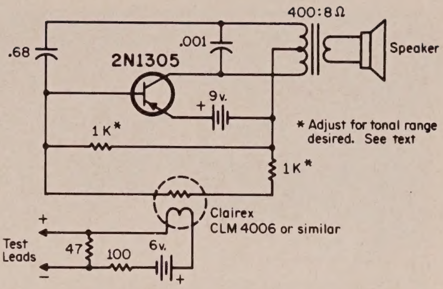


Fig. 2—Combined circuit of the lamp-photocell unit and a simple tone oscillator.

The shunting resistance of the circuit of fig. 1(A) is about 150 ohms and that of fig. 1(B) less than 50 ohms. This means, particularly in the latter case, that the unit can be used for in-circuit semiconductors testing since in most cases its shunt resistance will be lower than that of the shunting impedance in most transistor circuits.

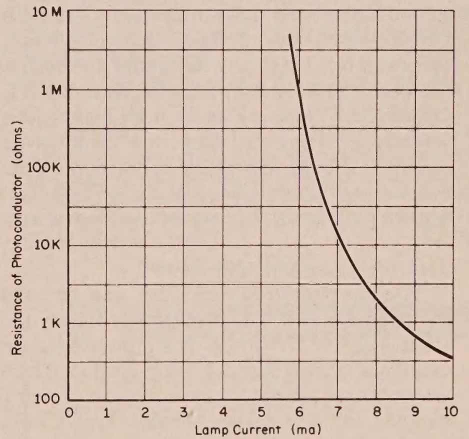
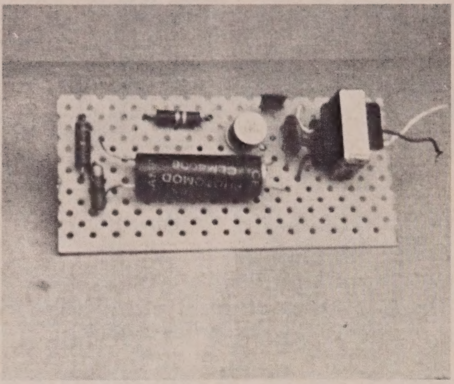


Fig. 3—Various lamp-photocell units can be used but one should first determine their resistance change behaviour. Characteristics shown is for Raytheon CK-1116 unit which has a 4 volt, 17 ma lamp. Increasing lamp current to the full 17 ma only causes a further resistance change to 350 ohms.



The entire tester can be assembled on perforated board stock and mounted in an enclosure as the builder desires. Tubular object in foreground is the lamp-photocell unit with the oscillator output transformer on the right.

Many different lamp-photocell units can be used besides the Clairex unit mentioned in fig. 1. RCA and Raytheon both produce a line of these units. By proper choice of a lamp unit and a biasing circuit, one can obtain a wide range of input current ranges and voltage levels. The circuits shown were only meant to sense extremes of resistance change at the test terminals and not provide a continuous photocell resistance variation with varying test resistors. The circuits will not, for instance, detect any difference between a 1K ohm and 10K ohm resistor. By using different lamp-photocell units with higher bias voltages or using the lamp in a bridge type circuit, it should be possible to develop a wide range aural ohmmeter. That was, however, not the purpose of this simple test instrument.

Oscillator Circuit

The lamp-photocell of fig. 1 can be used with any type of audio oscillator where the frequency can be varied by simple resistance change. Figure 2 shows a lamp-photocell unit used with an oscillator circuit typical of many simple CPO types. Many module type CPO's are not suitable, however, since they do not provide for an external tone control, except perhaps a combination volume/tone control when a potentiometer is used in the speaker lead. The wattage rating of the photocell resistance is not suitable for such usage. Besides, one can often buy the individual circuit components for less than the cost of a module.

The two 1K ohm resistors shown in fig. 2 may initially be 10K ohm potentiometers to allow finding the optimum value of these resistors that produce the most distinct tone variation. With the test leads alternately open and short-circuited, the two potentiometers are adjusted for a distinct *low* frequency tone when the leads are *short* circuited and a distinct *high*-frequency tone when the leads are *open*-circuited.

Construction and Usage

After the potentiometer settings have been determined, fixed value resistors can be used and all the components assembled on a piece of perforated board, as shown in the photograph. The mounting of the board in an enclosure with a miniature loudspeaker, battery holders, etc. can be done in any manner desired by the builder. Note that the test leads should be marked as to polarity.

A little bit of practice with a few diodes and transistors will quickly acquaint one with the usage of the unit. When a low-voltage battery alone is used directly in series with the lamp-photocell unit, one will note a distinct time delay as the lamp brightens and the cell resistance decreases. This produces a sort of wailing effect from the oscillator when testing across a very low resistance. It is surprising after a while how handy such a unit can be as one can concentrate on finding the correct terminals on a transistor to test rather than have to glance at a meter during which time one usually slips his hand away from a test point or lead. If the test prods are distinctly marked as to polarity, one can determine diode or transistor junction types the same as with an ohmmeter.

In-circuit testing of semiconductors is especially simplified since one does not have to glance away from a P-C board. Usually the tester will produce a clear indication of the direction of a semiconductor junction. If it does not, either the junction is defective or the shunting impedances are too low to permit proper tester operation. The only way one can determine which condition exists in such a case is to remove one end of the semiconductor junction from the circuit for direct connection to the tester. ■

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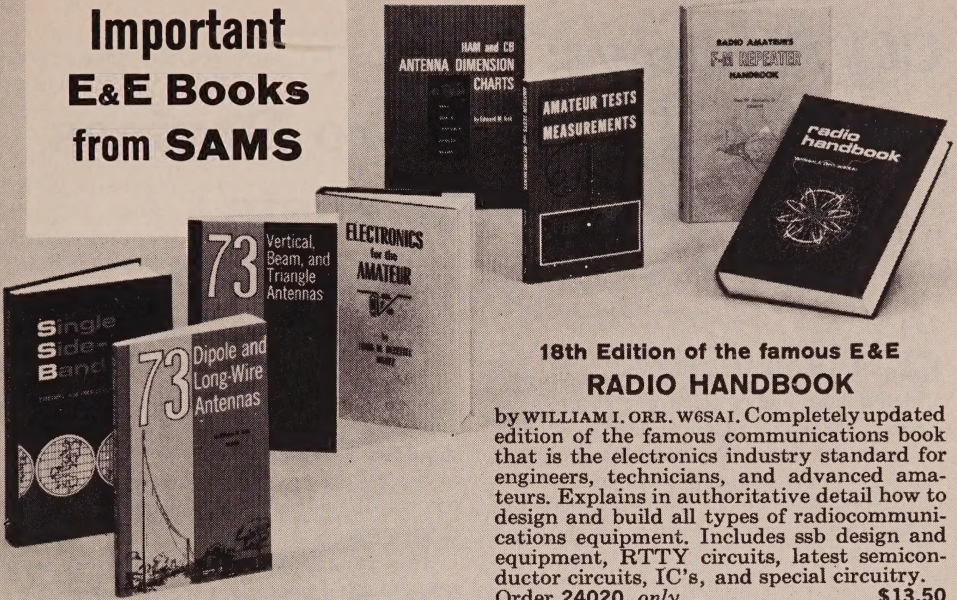
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CQ Reviews:
The Curtis Electro Devices Electronic Fists

BY WILFRED M. SCHERER,* W2AEF

CURTIS Electro Devices has come out with a high-quality line of electronic keyers identified as the Iambic Deluxe Electronic Fist. Of these, the model EX-39M Mnemonic unit is just about the most sophisticated job we've run across. Being an old die-hard adherent to semi-automatic manual keying, we've stayed away from the use of electronic-type keyers in favor of our old faithful bug, but after operating the EK-39M for one evening, it looks as if we'll at last be converted.

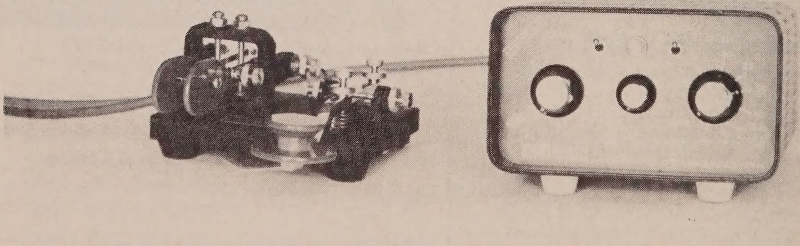
This keyer, at least for us, is one of the easiest to master and get accustomed to, in addition to which it enables the simulation of some of the individual keying characteristics available with the bug.

One feature that makes this possible is a variable weighting system by which the dots may be lengthened as desired for smoothest operation at any chosen speed. This also can provide better readability under certain conditions. Another result is more pleasant c.w. copy by getting away from the stilted and jerky type of code transmissions so often noted with electronic keyers when operated at certain speeds using the standard 1:3 dot-to-dash ratio to which many are limited.

Another special feature is a plug-in message memory (or c.w. identifier) that provides automatic self-sending of a pre-programmed sequence with the exact speed and weighting in use by the operator. Complete operating control of this setup is provided at the key mechanism.

This is particularly advantageous for contest and other operations where the keyer by itself may be engaged to automatically transmit CQ's, test signals, etc., along with the station call, giving the operator resting time or enabling hands to be kept free for other duties such as catching up with the log, having some refreshment, etc.

Other features of the EK-39M are: instant-start self-completing dots, dashes and spaces; faultless dot memory, Iambic operation (alternate dots and dashes) for squeeze-type keying; use also with single paddle (non-squeeze keying); provision for manual straight keying; 8-50 w.p.m. calibrated speed range; jam-proof spacing; solid-state or relay output keying for use with a wide variety of transmitter keying setups; sidetone monitor with level control and built-in loudspeaker; transmitter-tune position; shielded connectors and cables for r.f. immunization; regulated



Curtis Electro Devices Model EK-39M Mnemonic Iambic Deluxe Electronic Fist, shown with Brown Brothers Model CTL Key. The other Electronic Fist models are similar in appearance.

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*Technical Director, *CQ*.

power supply operated from 117 v.a.c. (220 v.a.c. on special order).

Other Models

The Iambic Deluxe Models EK-38 and EK-39 have the same features as found in the EK-39M, except for the plug-in message memory setup. The EK-38 also is minus the variable weighting.

All models are available as factory assembled units, but the EK-38 and EK-39 may also be had in kit form supplied with a preassembled circuit board, requiring only the mounting of the board, controls and connectors to which the board is then to be wired. Three to four hours are required to do the job.

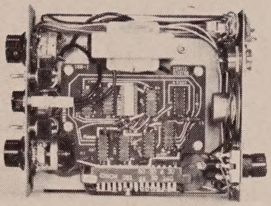
Operating Details

Since most operators are probably more interested in the operating features of an electronic keyer, rather than the more intricate and less understood technical details (unless you're well acquainted with the operation of IC's used as flip flops, inverters, gates, multiplexers, memories, etc.) We'll discuss *what* the keyer does, instead of going into a detailed technical discussion on *how* it does it.

Self-completion of dots ensures that no matter how short a time the dot paddle is depressed, the length of the dot will turn out to be that required for the particular sending speed (and weighting). A perfect self-completing dash is obtained with just the tap of the dash paddle. Similarly, a properly timed space is obtained no matter how soon a change is made between operating one paddle or the other for a dot or dash (jam-proof spacing).

Iambic operation for squeeze-type keying permits alternate dots and dashes to be had with a minimum of hand manipulation at the paddles. What takes place here is that the dot paddle may be held depressed for a string of dots with a dash inserted with proper spacing at a desired time simply by tapping the dash paddle. Similarly, a dot may be inserted into a string of dashes. Both paddles held depressed will result in alternate dots and dashes, or vice-versa, depending on whether the dot or dash paddle was first depressed.

A single paddle also may be used, in which case it is pushed in one direction for automatic dots, and in the other direction for automatic dashes. Operation is similar to that with a semi-automatic key, such as a bug, except *both* dots and dashes are automatically formed.



Top view of the EK-39M showing the message-generator board. The custom IC memory is plugged in near the center of the upper row of IC's. It is the light-colored IC.

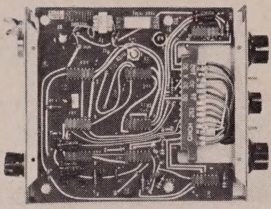
Manual operation with a straight key also may be had with the key plugged into the keyer unit, in which case the keying will exactly follow the hand keying.

Adjustable Weighting

The maximum counter-clockwise position of the adjustable-weighting control provides "standard" operation; that is, equal-length dots and spaces with the length of each dot equal to one-third that of a dash (1:3 dot-to-dash ratio). Advancing the weighting control lengthens the dots and consequently shortens the following space, as both functions occur within the time it takes for two-thirds of a dash (since one normal dot equals the length of one space and the length of three dots is equal to that of one dash). As the dots are thus lengthened, a point can be reached where the dots, or dots and a dash, run together, because of the diminished spaces. The effect is more pronounced at the higher code speeds, so the degree of increased weighting that can be tolerated is thus dependent on the speed.

The primary advantage we've experienced with the increased weighting, is that at speeds above 15 w.p.m. or so it makes it easier to latch on to operating an electronic keyer. Besides some of the other advantage mentioned earlier, many operators also find that under adverse conditions the longer-than-normal dot is more pronounced and thus reduces copying errors particularly where the call sign is involved.

Where a closed key is required for transmitter tuneup, this function is available by pulling out the speed-control knob. The Model ED-38 had an additional tune control



Bottom view of the EK-39M showing the circuit board for the basic keyer setup. A similar board is used for the other models.

which is a pushbutton that may be momentarily engaged for a quick tune-up check without disturbing the speed-control knob.

The sidetone monitor produces a pleasant-sounding tone that appears to be a good sine-wave in contrast to the squeaky and raspy-sounding monitors often encountered. The normal audio frequency is about 700 c.p.s., but this can be altered by an internal control to suit the individual operator's taste.

Output Circuit

Keyer-activation of the transmitter may be had with a transistol or a reed-relay output circuit (the relay is an optional accessory). Either grid-block or cathode-keying may thus be handled. The maximum rating for these keying facilities are: −150 v.d.c., 50 ma using the transistor output; with the reed relay it is ±200 v.d.c. or peak a.c., 750 ma or 10 VA, whichever is greater[1]. Either type of output circuit may be selected by a slide switch on the rear panel. Instructions are furnished on how to determine the transmitter keying-circuit voltage, current and polarity.

R.F. Immunity

The keyer is immunized to ordinary r.f. conditions through the use of internal by-passing and shielding, including shielded Amphenol-type connectors and shielded cables (supplied with the units). Should stray r.f. otherwise interfere with the operation of the keyer, the symptoms of malfunction related thereto and remedial measures are explained in the manual.

Message Memory

The message memory provides three different sequences. Any one of these may be selected by a 3-position toggle switch. Another 3-position switch sets up the circuitry so that the selected message sequence will be transmitted once, continuously or repetitiously with a 10-second pause between each transmission.

The message generator is started by momentarily closing an external start switch or by tapping the paddle of a straight key connected to the start circuit. The message generator can be stopped at any point by tapping the dash paddle. This feature allows break-in to the message sequence at any point. Once stopped, however, the message generator is automatically recycled for a fresh start at its beginning when it is again needed.

Our unit was supplied with the following messages:

(A)–CQ CQ DE W2AEF K
(B)–CQ TEST CQ TEST DE W2AEF K
(C)–DE W2AEF K

Other suggested material, besides the station call, might be: CQ DX, CQ FD, CQ CD, CQ SS, QRZ, etc.

The EK-39M is supplied with all the elements and circuitry necessary for message generation, except for the message memory itself which is a plug-in 3/8″ x 7/8″ custom IC Read-Only-Memory (ROM). This is a separate item (at additional cost) that must be programmed at the factory as per instructions from the customer.

The maximum length of each message that can be handled by the memory is limited to 256 "bits" of information as determined by the total "weight" or "count" required for each character in the message. The count for the different characters varies between 4 and 22. These are listed in a table in the manual.

The Curtis Electronic Fists are well built using high quality components installed on plug-in glass-epoxy circuit boards. The EK-38 employs 7 IC's, 12 diodes and two transistors. One more IC and diode are used in the EK-39. The EK-39M Mnemonic Keyer has the same keyer board plus a second circuit board for the message-generator setup which employs four SSI (small-scale integration) devices used to control the 256-bit ROM. Also included on this board are 6 diodes and 1 transistor. The custom integrated-circuit memory plugs into a socket on the board. When the memory is not installed, a wire jumper plugs into two of the socket pins.

The keyer is housed in a heavy-gauge wrap-around case. It is available with panel

[*Continued on page 86*]

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[1] An optional 100 VA mercury-wetted relay also is available, as may be desired for marine operators.

DIAL SET
P.A. LOAD
P.A. TUNE
CAR BAL
CAL REC TUNE CW
S METER
PA CATH
SWAN Cygnet
R.F. GAIN
A.F. GAIN
NORM OFF
MODEL 270B
SINGLE SIDEBAND
TRANSCEIVER
MIC GAIN
MIC

The new SWAN 270B transceiver has the same...

- **UNEXCELLED PERFORMANCE**
- **RUGGED RELIABILITY**
- **PORTABILITY**
- **260 WATT P.E.P. RATING**
- **5 BAND COVERAGE**
- **FINEST CRYSTAL FILTER**
- **CRYSTAL CALIBRATOR**
- **BUILT-IN SPEAKER**
- **AND AC POWER SUPPLY**

...as the Swan 270

BUT IT'S NEW LOW PRICE IS ONLY $499

This price reduction has been achieved by making 12 volt DC operation an optional plug-in accessory. The DC components are now contained in a 1½ x 3 x 4 inch box which plugs in back of the 270 B, in place of the AC connector. Servicing and maintenance are made easier, and we are able to pass the savings in cost on to those of you who do not require 12 volt operation. The DC converter, model 14A, may be purchased at any time. Except for this difference, the 270 B is identical to the 270. It is truly a top notch performer and an even better value. See the new 270 B at your SWAN dealer today.

Model 270 B	**$499**
Model 14A, 12 volt DC converter	**$39.50**

Dept. D

ARROW ELECTRONICS, INC.

18 Isaac St., Norwalk, Conn.
203 838-4877

97 Chambers St., N. Y., N. Y.
212 DIgby 9-4411

525 Jericho Tpke., Mineola, N. Y.
516 PIoneer 2-2290

225 Rte. 46, Totowa, N. J.
201 256-8555

900 Rte. 110, Farmingdale, N. Y.
516 MYrtle 4-6822

195 W. Route 59, Nanuet, N. Y.
914 623-6444

207-02 Northern Blvd., Bayside, N. Y.
212 423-0910

ANNOUNCING

THE NEW CQ DX AWARD PROGRAM

In the DX column of the November issue we mentioned that the *CQ* DX Award's Advisory Committee was working on a plan to restructure our award for working countries. This job is now complete, and we are pleased to present to you the rules for the new awards. These rules become effective Jan. 1, 1971, at which time the old CQ SSB DX Award will be superceded by a new CQ SSB DX Award, *and,* for the first time, a CQ CW DX Award will be offered. Jerry Hagen, WA6GLD, will be Manager for both awards which will be separate certificates enabling the same operator to apply for both. A re-start will not be necessary as QSL cards for contacts after Nov. 15, 1945 will be acceptable.

Applications

1. The CQ CW DX Award and CQ SSB DX Award are issued to any amateur station submitting proof of contact with 100 or more countries (See Rule 3) on c.w. or s.s.b. Applications should be submitted on the official CQ DX Award Confirmation List.

2. QSL cards must be clearly marked for the mode, either 2 X SSB or CW and must be listed in alphabetical order by prefix. All contacts must be dated after Nov. 15, 1945 and must be made from the same call area.

3. QSL cards must be verified by one of the authorized checkpoints for CQ DX awards, or must be included with the application. If cards are sent directly to the Award Manager, or mailed to a checkpoint, postage for their return to the applicant by first class mail must be included. If Certified or Registered mail return is desired, sufficient postage should be attached.

4. Country endorsements for 150, 200, 250, 275, 300, 310, and 320 countries will be issued (See Rule 3).

5. To promote multi-band usage, two special endorsements are available:

a.) A Low Band Endorsement will be issued to stations contacting 100 or more countries using any combination of the 7 and 3.5 mc bands.

b.) A 28 mc Band Endorsement will be issued to stations contacting 100 or more countries on the 28 mc band.

6. Any altered or forged confirmations will result in permanent disqualification of the applicant.

7. Fair play and good sportsmanship in operating are required of all amateurs working toward CQ DX awards. Continued use of poor ethics will result in disqualification of the applicant.

8. A fee of $1.00 or 8 IRCs to defray the cost of the certificate and handling is required for each award. An s.a.s.e. or 1 IRC is required for each endorsement.

Country Status

1. The ARRL DXCC country list constitute the basis for CQ DX Award country status. Deleted countries will *not* be valid for the CQ DX Award. Once a country has lost its status as a current country it will automatically be deleted from our records.

2. All contacts must be with licensed land based amateur stations working in authorized amateur bands. Contacts with ships and aircraft cannot be counted.

3. Decisions of the CQ DX Awards Advisory Committee on *any* matter pertaining to the administration of these awards shall be final.

CQ DX Honor Roll

1. The Honor Rolls will list all stations with a total of 275 countries or more.

2. Separate Honor Rolls will be maintained for SSB and CW.

3. To remain on the Honor Roll, a station's country total must be updated annually.

Applications for the CQ CW and SSB DX Awards and Honor Rolls should be submitted to:

CQ DX Award Manager
Jerry Hagen, WA6GLD
P.O. Box 1271
Covina, Calif. 91722

w7gu3al / w7gu

DX

BY JOHN A. ATTAWAY,* K4IIF

As another year rolls around and we begin to anticipate great DX events not yet disclosed, we can take a parting look at 1970 with a great deal of satisfaction. It was a vintage year. The greatest of all DXers, Gus Browning, was once more on the DXpedition trail and passed out new ones to many of the gang from the rarest spots of the Indian Ocean. However, perhaps the most significant event was the successful kickoff of the International DX Association by WA5REU, W3-DJZ, K3RLY, and PY2PE. This outstanding group could well be the YASME Foundation and World Radio Propagation Study Association of the 70's, all rolled into one. Their trademark is DXpeditions using operators from the same area as the rare spot, for example their East Pakistan operation by a licensed amateur from West Pakistan. This makes a lot of sense both financially and politically.

A healthy trend which this column enthusiastically endorses is the move away from complete U.S. domination of the DXpedition

HB9AMY logging them in during his August 14-16 DXpedition to Liechtenstein as HB0AMY. QSL to Lele at P.O. Box 768, Lugano 1, Switzerland.

WPX HONOR ROLL

The WPX Honor Roll is based on confirmed current prefixes which are submitted by separate application in strict conformance with the CQ WPX Master Prefix List. Scores are based on the current prefix total regardless of an operators all-time prefix count.

MIXED

W4OPM	Joe Hiller	1000
W9WHM	John R. Leary	811
W8LY	Michael A. Bakos	785
K0BLT	Frank Cahoy	733
W8ROC	Frederick Riecks	729
G3DO	D. A. G. Edwards	721
K1SHN	Chuck Banta	714
W3PVZ	Joseph M. Olnick	707
VE3GCO	Garry V. Hammond	702
I1SF	Serafino Franchi	690
WA5LOB	James Edwards	680
W4IC	George A. Mack	676
CT1LN	Paulo J. S. Coelho Vieira	652
DL1MD	Heribert Rechl	646
W4BQY	G. B. Fisher	639
WA6EPQ	Larry Brockman	617
YU1AG	Djura Borosic	614
W8KSR	Jon Hodgin	609
W4CRW	Robert Sommer	604
W8GMK	John Marhefka	592
WA0CPX	Edward C. Gray	550

SSB

W4OPM	Joe Hiller	899
W4NJF	Gay E. Milius	835
DL9OH	Karl Muller	690
K2POA	Arthur Johnson	674
WA5LOB	James Edwards	673
HP1JC	Juan G. Chen	644
G3DO	D. A. G. Edwards	622
W3DJZ	Arden B. Hopple	620
I1AMU	Alfonso Porretta	619
K1SHN	Chuck Banta	604
I1KDB	Giampaolo Nucciotti	599
F2MO	Michel Dort	581
W4IC	George Mack	562
W6YMV	Paul Friebertshauser	553

CW

W4OPM	Joe Hiller	850
W8LY	Michael A Bakos	786
W2AIW	Charles Rogers	776
VK3AHQ	Henry Denver	753
W8KPL	William W. Simpson	750
DL1QT	Helmut Baumert	744
W2HO	W. Vollkommer	720
ON4QX	Bob Berge	682
W9FD	W. W. Johler	680
WB2FMK	Robert J. Rasche	628
G2GM	F. D. Cawley	598
K1SHN	Chuck Banta	588
VE4OX	D. E. McVittie	579
I1SF	Serafino Franchi	571
YU1AG	Djura Borosic	569
W8GMK	John Marhefka	562
OK2QX	Ing. Jiri Pecek	556
K1LWI	Wendell Boyden	550

PHONE

W9WHM	John R. Leary	813
G3DO	D. A. G. Edwards	708
W3DJZ	Arden Hopple	654
CT1LN	Paulo J. S. Coelho Vieira	619
CX2CN	Samuel Barreiro	574
I1SF	Serafino Franchi	568

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*P.O. Box 205, Winter Haven, Fl. 33880.

scene. The operations by groups headed by OH2BH and DL7FT were significant milestones.

Finally, the new *CQ* C.W. and *CQ* S.S.B. DX Awards, with separate honor rolls for each mode, give the gang here at home a fresh incentive.

All in all, the 70's look like the decade of DX.

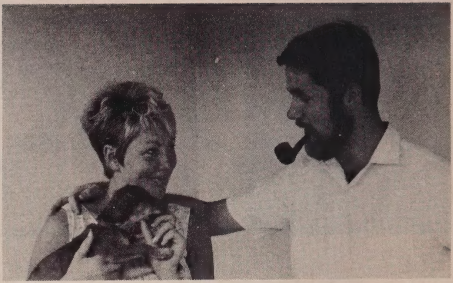
De Extra

We have a guest columnist this month who has some thoughts about the pending ARRL DX Committee. He is G. L. Baker, W5QPX, the friendly voice from the high plains of west Texas. Here's what he has to say:

> "There appears to be a lot of chatter lately about an (ARRL) DX Advisory Committee. Either it has escaped me, or it hasn't been stated yet, what this Committee's objectives will be. Is it to rule on country status? To determine who shall go DXpeditioning? To finance such ventures? Or just what is it to do?
>
> "A particularly important point which hasn't been clarified is *who* will make up this Committee? I hope that those who select this group will be very careful in their choice of members. Personally I think that a candidate for this group should possess a minimum of 3 of the following 5 qualifications:
>
> 1. Hold at least one DX call in addition to his regular call.
> 2. Should have been a licensed amateur for a minimum of 10 years.
> 3. Should be a QSL Manager for at least 3 DX stations.
> 4. Be a U.S. citizen who has been licensed, operated, and resided in a foreign country.
> 5. Be a foreign national residing in the U.S. and operating under the reciprocal licensing program."

Mr. Baker's points are good. The ARRL DX Advisory Committee can be very beneficial to DX Worldwide if it is made up of people who really care and are well informed. If, on the other hand, it is composed of people whose chief qualification is their ability to "get along" with the Headquarters staff, it will be simply a mockery. Think it over.

Jim Sayer, VP9BY, of Smith's Parish, Bermuda. Jim hosted K4SHB and Company for the 6-band multi-operator shindig during the CQ World Wide Phone Contest in October. A prettier set-up you won't find anywhere in the world.



Paul, PJ2PS, and his XYL Ine. Paul has provided QSLs for thousands of stateside hams looking for a Curacao card. (Photo courtesy WA3HMM).

Iowa DXers

WA0ETC and K0UKN are forming an Iowa DX Association. Interested amateurs should contact Larry Lindblom, WA0ETC, 4333 Lakewood, Norwalk, Iowa 50211.

160 Meters

The 160 news scene is dominated by the annual Trans-Atlantic and Trans-Pacific DX Tests. The frequencies and remaining dates for the Trans-Atlantic Tests are as follows:

GMT Dates: Dec. 27, Jan. 10, Jan. 24, and Feb. 14.
Times: 0500-0730 GMT.
Frequencies: W/VE east coast 1800-1820 kc, W/VE west coast 1975-2000 kc, Europeans mostly 1823-1830 kc.
Call: CQ DX TEST at alternate 5 min. periods with W/VE leading off.

The information for the Trans-Pacific Tests is as follows:

GMT Dates: Dec. 19, Jan. 2, Jan. 16, Feb. 6, and Feb. 20.
Times: 1330-1600 GMT.
Frequencies: W/VE west coast 1957-2000 kc, W/VE east coast 1800-1810 kc, Japanese 1907.5-1912.5 kc, New Zealand about 1876 kc (ZL3RB), and Australians 1802-1805 kc.
Call: CQ DX TEST at 5 minute intervals with W/VE leading off. First period on the hour or half-hour.
Special: JA sunset tests on same dates but 0730-1000 GMT saturday (11:30 friday night to 2 A.M. saturday morning North American west coast time.)

Reports of successful QSO's will be appreciated by W1BB.

CQ C.W. and CQ S.S.B. DX Awards

As of Jan. 1, 1971 applications for these awards may be submitted to the Award Man-

Vojta Zeman, OK2ZU, is quite active on 80-10 meters c.w. He has competed in several CQ World Wide DX Contests. *(Photo courtesy WA3KSQ).*

ager, Jerry Hagen, WA6GLD. His address is P.O. Box 1271, Covina, California 91722. **For complete rules, see page 59 in this issue of *CQ*.**

Those Hard-to-Work Russian Zones

The Zones of stations in central and eastern Siberia can usually be determined by referring to the first letter after the number of the prefix. For example, UA9, UK9, UW9, and UV9 stations having the letters H, O, P, U, V, or Y immediately after the figure 9, are in Zone 18. UA0, UK0, UW0, or UV0 stations having the letters A, B, O, S, T, U, or V immediately following the 0, are also in Zone 18, while UA0, UK0, UW0 or UV0 stations having the letters C, G, E, F, I, J, K, L, M, Q, R, or Z immediately after the 0 are in Zone 19. UA0, UK0, UW0, and UV0 stations with Y after 0 are in Tuva which is Zone 23.

All JT-Mongolia stations are in Zone 23.

Stations from these zones with frequencies where they have been worked are as follows:

ZONE 18—UV0AB, 14082 kc; UV0PX, 14208 kc; UA9VB, 14206 kc; UA0AI, 14258 kc; UA0AG, 14019 kc; and UW0BA, 14057 kc.

ZONE 19— UA0CW, 14007 kc; UV0IP, 14010 kc; UA0IW, 14023 and 14018 kc; UA0-IK, 14019 and 14025 kc; UA0JW, 14009 kc; UW0IW, 14015 kc; UK0LAB, 14059 kc; UK0KAA, 14020 kc; UK0WAA, 14013 and 14072 kc; UA0JO, 21004 kc; UA0IP, 21052 kc; UA0KLE, 14007 kc; UA0KHI, 14007 kc; UK0FAA, 14035 kc; UA0ED, 14024 kc; and RA0LEX, 28053 kc.

ZONE 23—UA0YD, 21015 and 21030 kc; UA0YT, 14039 kc; UA0YAE, 14005 and 14064 kc; JT1AH, 14044 and 14048 kc; JT1KAF, 14072 kc, and JT1KAA, 14023 kc.

The WAZ Program

The following list is based on applications received between Sept. 1 and Sept. 30, 1970.

S.S.B. WAZ

816	VE2NV
817	W3SS
818	WB2VZW

C.W.—Phone WAZ

3005	W8JJA
3006	WA8UYY
3007	F9TE
3008	K6OZL
3009	K4FP
3010	WB6NWW
3011	W6CNA
3012	JA1AS
3013	PA0INA
3014	G3WP
3015	GI3OLJ
3016	W9LAX
3017	W9JOE
3018	HP1BR
3019	LU1DNU

Phone WAZ

446........W8ZOK

Complete WAZ rules are shown on pages 64-66 of the June, 1970 issue of *CQ*. Application blanks and reprints of the rules may be obtained by sending a self-addressed, stamped envelope to DX Editor, P.O. Box 205, Winter Haven, Fl. 33880.

Rare and Unusual Prefixes

AX8—Ron, AX8ZQ, is on from the Northwest Territory of Australia. He is frequently heard around 14265 kc.

CP6—CP6DDS has been active on 40 meters, 7225 kc, around 0400-0500 GMT.

EL3—EL3YW is sometimes worked on s.s.b. near 14260.

FP0—FP0CA and FP0NQ were in the St. Pierre and Miquelon Islands where the FP8 prefix is more commonly used.

LJ2—LJ2L was reported on 14202 kc.

OK5—OK5TOL frequents the low end of 14 mc c.w.

PY6—This fairly rare Brazilian prefix is occasionally activated by PY6AK, PY6FI, and PY6BN on 21 mc c.w.

PZ5—PZ5RK was worked on 10 meter s.s.b., 28560 kc.

RB5—RB5UAD on 28040 kc was a v.h.f. station

The CQ S.S.B. DX Award Program

Listings for this program will continue until after all applications received prior to Dec. 31, 1970 have been processed. After Dec. 31, new serial numbers will be started for the modern s.s.b. award and the new c.w. award.

100 Countries	
657	W8NNR
658	WA0ETC
659	WB6WAV
660	I1KDB
661	PY1DBE

200 Countries	
210	I1KDB

300 Countries	
54	F9MS
55	I1KDB

The WPX Program

S.S.B. WPX

546........DL1EG
547........DL5GJ
548........W8NNR
549........PY1DBE
550........WA1LDA
551........WB2DLF

C.W. WPX

1056........4X4MN
1057........DL1FZ
1058........OH6NH
1059........JA1FGB
1060........K1WJB
1061........W6RGG

Mixed WPX

250........PA0UV
251........WB6NWW
252........W4CRW
253........W6RGG

Special Contest WPX

16 (S.S.B.)........VE3BMV

WPNX

23........WN2KLB

WPX Endorsements

S.S.B.: OH6NH–500, CT1LN–500, CX9CO–500, W9GHO–300, WA0ETC–300, WB2FMK–300, and PY1DBE–250.

C.W.: WB2FMK–650, OK2QK–550, ZL4BO–500, W2NEP–450, and W6CLM–350.

Phone: CT1LN–600.

Mixed: VE3GCO–700, CT1LN–650, ZL4BO–650, W4HOS–600, W4CRW–600, and CX9CO–550.

20 Meters: OK2QK.

40 Meters: OK2QK and WB6FMK.

Africa: ZL4BO.

Asia: OK2QK and ZL4BO.

Europe: 4X4MN and ZL4BO.

North America: ZL4BO.

Oceania: VE3GCO and ZL2BO.

South America: ZL4BO.

in the Ukraine. Ten meters is considered a v.h.f. band by the Soviets, and callsigns beginning with R always indicate v.h.f.'ers in the USSR.

RI8–Soviet VHF station in Uzbek. RI8IAC has been active near 28050.

RJ8–RJ8JBR in Tadzik has been worked on 28592.

RR2–RR2TAG is a 28 mc station in Estonia. He was worked on 28500 kc a.m.

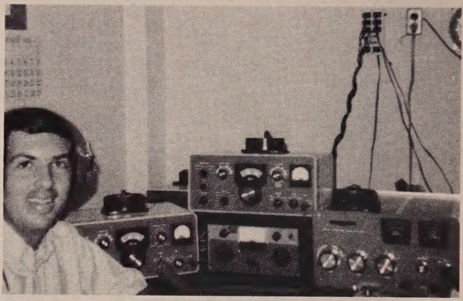
YT0–YT0M has been reported on 21053 kc c.w.

YU0–YU0SRJ likes 14 mc c.w. and frequently is heard near 14075.

4J0–4J0U operated from the Soviet Republic of Georgia.

QSL Information

The following volunteers to be QSL Managers for DX stations: Dana Polan, WA2JLV, RFD #2, Box 44A, Putnam Valley, N.Y. 10579 and Richard Nelson, WB2IQF, 181 Oak Ridge Ave., Summit, N.J. 07901.



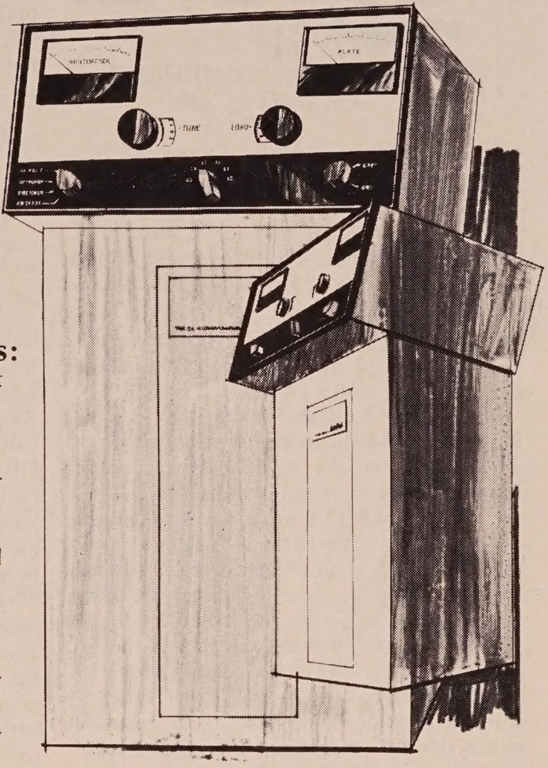
TJ1, Cameroun is not so rare these days thanks to Charlie, TJ1AW, who is active on all bands. He will be there for 2 years. QSL to Les, K4ZCP, P.O. Box 626, Hickory, N.C. 28601.

AP2KS–Via INDXA, Box 125, Simpsonville, Md. 21150.
AX2ABW–To K2YLP.
AX2BKM/LH–c/o W2CTN.
AX9KS–Via W1YRC.
AX9XI–To W2GHK.
C21JW–22 Berry St., Cronulla, N.S.W., Australia.
CE0AE–Cards for Father Dave only go to WA3HUP, 105 June Dr., Camp Hill, Pa. 17011. Other operators using this call do not send their logs to Mrs. Crider.
CT1LN, CT1OF, CT2AA, CT2AP, CR6GA–All to WA3HUP.
CR5SP–Box 97, Sao Thome, West Africa.
CR9AK–c/o CT1BH.
DA2XA–Via DL5XW.
EL2CB–To W2CTN.
ET3DS–c/o VE3DLC
FB8WW–Via W2AIW.
FK8AC–To WA6MWG.
FM7WQ–c/o W4OPM.
FO0TC–Via W9CTY.
FP0NQ–To W2NQ.
FW8BO–c/o FK8BO, Box 28, Noumea, New Caledonia.
FW8DY–Via Ed DeYoung, 95213 Waimeli Place, Waipio, Hawaii 96786.
FY7YR–To VE3BYN.
HH9DL–(Oct. 20-25, 1970 QSO's only)–c/o W6WLH.
HP8C–Via HP1AA.
HS1ABU–To W5ZG.
HS4ADS–c/o WB6RYN.
JD1ABO–Via JA1BA.
JT1KAA–P.O. Box 23, Ulan Bator, Mongolia.
KC6BW–To WA3HUP.
KC6RS–c/o W6MMG.
KF4GSC–Via W4DQD.
KH6HCM/Kure–To KH6HCM.
KJ6CF–AEC Radio Club, Box 101, APO San Francisco, Ca. 96305.
KM6CE–c/o WA3HUP.
KP6AL–Via K3RLY.
KR6AY–To K0VXU.
LG5LG–c/o LA1YS.
M1B–Via WA3HUP.
M1D–To I1MKN.
PJ9JR–c/o W3ZKH.
TJ1AW–Via K4ZCP.
TJ1AZ–To K4ASI.

[*Continued on page 84*]

The new 2K-4

"IT'S EVEN BETTER THAN THE 2K-3."



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Q AND A

BY WILFRED M. SCHERER,* W2AEF

75S-3B with 2-Meter Converter

QUESTION: I have a 2-meter converter that employs a 7.222 mc 3rd overtone crystal. It worked fine with my HQ-129X receiver. I now have a Collins 75S-3B and wish to use the converter with it. How should it be converted or set up?

ANSWER: Judging from the crystal frequency you gave (7.222 mc), the converter is supposed to work with a 14 mc i.f.

With the 75S-3B set for the 14.0-14.2 mc range, the 144 mc range would be 144.0-144.2 mc. With the 14.2-14.4 mc receiver range, the 144 mc range will be 144.2-144.4 mc. On the 14.8-15.0 mc receiver range, the 144 mc one will be 144.8-145 mc.

Coverage on other segments of the 144 mc band will require changing either the converter crystal or that in the 75S-3B.

The converter-crystal frequency is the required oscillator-signal frequency divided by 18. The required oscillator-signal frequency is the low end of the desired 144 mc segment minus the low end of the i.f. segment provided by the 75S-3B.

For example: for 146.4-146.6 mc using the 14.0-14.2 mc segment of the 75S-3B, the required oscillator-signal frequency is $146.4 - 14 = 132.4$ mc. The crystal frequency is $132.4 \div 18 = 7.3555$ mc.

HT-37 on MARS Frequencies

QUESTION: How may the Hallicrafter HT-37 be modified for MARS operation in the 15.5-16, 17-17.5 and 20.5-21 mc bands? Would altering the v.f.o. be necessary?

ANSWER: In respect to modifying the HT-37 for MARS operation, altering the v.f.o. would not be a satisfactory or practical method.

Operation in the 15.5-16 mc segment would be best accomplished using a crystal-controlled oscillator applied to the second mixer, V_8, instead of the v.f.o. Since MARS operation is conducted on specific frequencies use of crystal control is practical as well as being desirable. Use the 20-meter position. The crystal frequency should be the desired output frequency *minus* 9 mc. A variable trimmer across the crystal will allow you to tune it exactly to the channel frequency. Retuning of the mixer and driver output circuits will be needed and it may be necessary to reduce the p.a. tank inductance by a turn or so (move the 20-meter tap).

Operation in the 20.5-21.0 mc area may be had by using the 15-meter band and changing the 25 mc heterodyning crystal to a 24.5 mc one. Circuit realignment also may be needed.

There does not appear to be a simple and practical method for 17-17.5 mc operation without extensive modifications.

RTTY QRM on 28 mc with HQ-215

QUESTION: On the 28.5-28.7 mc range of my HQ-215 receiver, I receive tunable RTTY signals at a number of points. I believe the RTTY originates at a lower frequency since I do not receive it on an SX-100. An RME DB-23 preselector eliminates the problem, but I don't think it should be necessary.

ANSWER: RTTY interference in the 28.5-28.7 mc range of the HQ-215 is most likely caused by teletype signals in the 17-19 mc range, harmonics of which beat with the h.f. oscillator to produce a signal at the image frequency. The harmonics may be generated in the r.f. stage (mainly due to overload) which is an easy possibility with transistors, even with the f.e.t.'s. This is only one possibility for the RTTY QRM. Other frequency combinations could introduce the problem with the particular conversion scheme used.

The signals could also be from RTTY stations in the 8, 11 and 12 mc bands. What the RME DB-23 does is to add additional selectivity that rejects these signals. A trap, at the antenna input, tuned to approximately 8, 11 12 or 18 mc would accomplish the required rejection as would a 20 mc hi-pass filter.

C.W. With SB-34

QUESTION: I am interested in converting my SBE-34 to include the c.w. mode. Would keying the "tune" function be a solution?

ANSWER: Data on c.w. operation with the SBE-34 will be found in the September 1968 issue of *CQ* in an article entitled, "The SB-34 Transceiver, Expanded Coverage and Convenience."

73, Bill, W2AEF

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*Technical Director, *CQ*.

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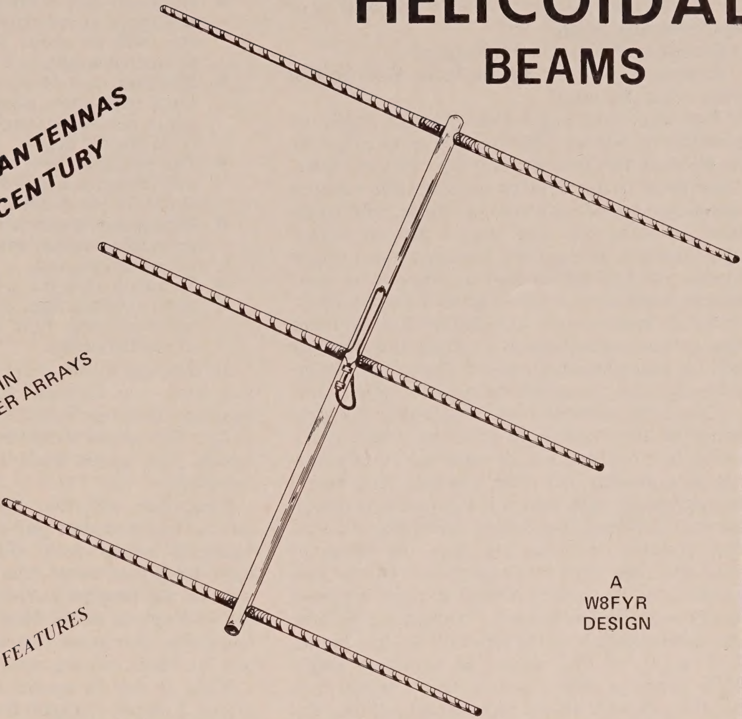

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CONCERNING TOWERS AND THEIR INSTALLATION

There are many kinds of towers on the market today. You may choose the kind that requires guying or the type that is self-supporting. You may select a foldover, a crankup or the kind that hinges at the base and then either folds over or cranks up. Then there are the rigid types that rise section by section after the base has been securely planted. Towers are made of steel or aluminum. They can be of telescopic masting or braced triangular or of square-framed design.

Confusing? You can say that again!

So how do you sort out the facts? How do you know what *you* want?

First you must know what you can legally or permissively put up. This depends upon either the landlord or the zoning restrictions in your town. Then there is the aesthetic consideration meaning mainly your good wife and, of course, your neighbors' opinions, too. For you to put up a stark ugly structure on the front lawn on a street of fine homes, you had best at least be prepared for some tongue wagging, or worse, a letter from the neighborhood improvement association. But assuming that such considerations as to where this structure will be placed have been settled, then you must decide what the tower will be used for specifically.

The tower selected must reflect the maximum windload in a horizontal direction which is imposed by your antenna, or combination of antennas plus masting and rotor assembly, assuming a velocity of 80 mph (which is the minimum recommended standard). Depending upon historical weather statistics for your area and the nature of your site, you must be conservative. On the bare exposed lot the potential wind damage is greater than in a tree-shrouded yard. Go ahead then in adding up windload. With the small TV or VHF beams, 2–5 sq. ft. of load should be expected. Larger VHF beams or small 10 meter arrays require 5–8 sq. ft.; 2 element tri-band quads also fall into this category. Typical tri-band 3 element beams require 8–11 sq. ft. A typical small VHF antenna stacked on top of a 3 element tri-band beam requires a total of 11–14 sq. ft. Two small HF 10 or 15 meter 3 element tri-band beams would call for 14–18 sq. ft., while even a single large 20 meter array requires 18–22 sq. ft. Even the light 40 meter beam needs 26 sq. ft. By the way, the sq. ft. of windload times 20 equals the lateral pressure in pounds at 80 mph. At 90 mph you multiply by 25, at 100 mph you multiply by 30, at 115 mph by 40, at 130 mph the factor is 50, and at 160 mph you will use a multiplier factor of 60. And when you do all these calculations be conservative. In still another direction, that of your future ham operations, allow for the fact that you may want to expand your activities and thus your antennas.

Bear in mind that the height of your antennas and the top of your tower must be at least 5–10 ft. higher than the average foliage in your backyard, and preferably should be halfwave or higher for the lowest frequency that you are going to operate on. Remember that the radiation lobes from your antenna are broad and bulbous shaped, and foliage has a way of interfering with these patterns. In general, quads will provide satisfactory operation at lower heights than yagis.

Secondly, your bankbook must be consulted. While it is true that a ham's station performance is more directly related to good antenna performance, it is also true that your first obligation must be to the family and their needs. Some idea of cost can be gleaned from the following:

- Minimum cost of steel in 10 ft. sections with guys, rotor plate, masting, anchors, etc., will be about $2.50 per lineal ft. of erected height.
- Minimum cost of aluminum in 8 ft. sections with rotor plate and masting (no guys) will approximate $3.20 per lineal ft. of erected height.
- The minimum cost of a crankup or foldover design in a guyed steel tower will be about $5 per lineal ft. of erected height.
- Minimum cost of a self-supporting crankup or foldover steel tower will be $8 on the same basis per foot.
- Minimum cost for a hinged base, aluminum construction, crankup or foldover self-supporting type will be $9 per ft. of erected height.

By referring to the above and knowing how high you wish your antennas to be, you can quickly compute minimum values for basic types of tower design. But please remember, these are minimum values, and prices have a habit of going up, not down!

Remember, too, that there are other considerations. You wouldn't put a guyed tower in your backyard where your kids were playing ball. First thing you would hear would be a hysterical wife on the telephone. Then, too, how frequently are you apt to move? How easy is the tower to erect? Do you need two or three cases of suds and the whole club for a rooting section?

While it can be agreed that in the case of 6 meter, 2 meter, or higher frequency operation that towers should be located reasonably close to the operating room, there nonetheless exist valid reasons why most tower installations should be located as distant from the house as is practicable. We recognize that the cost of low insertion loss coax is high but nonetheless when you evaluate the costs of putting the tower closeby as against the cost of putting the tower somewhat remote from the house, you will have to conclude that it is better to locate the tower further from the house. Here are the reasons.

Most towers sing. Literally all antennas sing when the wind whistles through, and this singing or whistling is most annoying when you are trying to sleep. (You can mitigate this annoyance in the case of your antennas by having a piece of thick twine or hemp or even rope dropped down inside of each of the aluminum tubes in such a way that the end of each cord will be cemented in place to the aluminum. This cord dampens out the vibration that otherwise in time will spell a marked deterioration in the life of the aluminum).

A detailed study of lightning phenomena illustrates that most lightning strikes are literally flows of electricity being emitted from the earth to the clouds. These bolts generally depart from the highest ground. The tower, of course, should be grounded well and obviously should be considered the highest ground on your premises to the extent that it is better for the tower to leak the discharge than it is for your house. Your tower should be located as remote from the house as possible. Even then a direct hit will likely cause some secondary damage, but this is certainly far less than would be the case if lightning struck your house.

Thirdly, a tower planted remote from the house and preferably shielded by trees for most of its height will likely prove easier to raise or lower than would be the case if the tower were contiguous to the house. A simple pulley and rope with an inexpensive boat winch fastened to the trunk of a strong tree will in most instances permit a substantially higher fulcrum point than will be the average house. In many typical installations the tower so located can be lowered for antenna work to a point near the house, and this is of course another advantage. But by far and away the biggest advantage lies in considering the potential loss that would occur to your house if the tower or antenna came crashing down.

We always recommend that the coaxial cable, rotor cable, power and signaling circuits be bunched together and run through an appropriate sized piece of PVC tubing such as is generally available from plumbing supply houses. This PVC tubing can then be slit trenched into the ground for safety and if gentle curves are used at either end a permanent installation will result which properly allows for expansion and years and years of service.

When we have a direct hand in any tower erection plan we invariably drive into the ground two, three or four long copper plated ground rods available from most electrical supply houses. These are driven in close to the tower base and then heavy 1" copper braid is soldered on each of these ground rods and thence tied on to the tower and the sheath of the coax. Where the soil is sandy and known to possess poor ground conductivity, a saturated solution of copper sulphate prepared in gallon lots can be poured into the soil surrounding each ground rod. This will definitely help the situation.

It is recommended that multiple coax be used for a multiple antenna installation on the tower, although Dow Key and others make long life antenna switching relays entirely feasible. Also, coax should be chosen with respect to its insertion loss and its apparent life at the time of installation. It is certainly better to use fresh coax than old, and it is better to use polyfoam coax than the old style, and it is better still to use RG34 than RG8, better still RG8 than RG58.

In the perfect installation constant impedance connectors are usually found rather than the similar PL259 type. Although the consequences of these changes are small for typical 80 to 20 meter operation they definitely help on 10 meters or higher.

When installing multiple antennas on top of a tower it is seldom possible to have each of the beams pointing in the same direction where maximum efficiency is expected. Substantial improvement in VSWR can be obtained by having every other antenna lead or lag by 90 degrees. As a follow-up, you can have a second pointer of a different color and marked appropriately glued or otherwise fastened to the indicating pointer by a similar number of degrees.

Please remember to operate at those frequencies which reflect the best VSWR characteristics of your antenna. Otherwise, the increasingly high VSWR will have a bad effect back at your transceiver or linear. You can easily determine your VSWR at different frequencies by means of an in-line directional coupler or you can carefully measure your antenna with either a Millen or an Omega bridge inexpensively available at most radio distributors, including this company.

We sell them all and literally have dozens of towers in stock. Each of us, however, has a situation which is likely to be different and therefore the tower which best fits your individual purpose may have to be specially selected and require a lot of careful study. Were you living in our general area, we would like nothing more than the chance to evaluate your situation with you, appraising your lot and your requirements in terms of the best tower available for the price that you can afford. We do this sort of thing for many New England hams, and perhaps we can do it for you even by mail. Detailed literature is available on every brand of tower, and we would be very happy if you know what you want so that we may quote on a package deal, including the rotor, the antenna and the tower combination as well as all of the accessories involved.

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THE awards PROGRAM

BY ED HOPPER,* W2GT

Special Honor Roll
All 3079 Counties!
#39—Clyde W. Stottlemyre, W0YLN 9-12-70
#40—George J. Pray, WA4FGX 10-5-70

THE January, "Story of The Month", about George Pray, WA4FGX after this interesting information on Awards issued.

Glad to see that Clyde, W0YLN, who has given out so many many counties, made All Counties for himself, and in so doing, of course also made USA-CA-3000.

George, WA4KGX, pleased and surprised me by suddenly applying for All Counties, 500 through 3079, see "Story".

That hard working Cleo Mahoney, WA0SHE qualified for USA-CA-3000, All A3A. (Hope you all realize we have a fine bunch of YLs/XYLs who devote *much* time for we County Hunters—God bless them!).

Like Clyde, (W0YLN), Larry Bromstead, W4GGU has given out so many counties as mobile and airnautical mobile, don't know when he found time for the necessary paper work. He hit the jack-pot and applied for 3000 All 14 mc A3A; and 2500, 2000, 1500, 1000 and 500 endorsed All 14 mc A3A Mobiles. (At this writing he is short very few for All Counties).

USA-CA HONOR ROLL

3000	
W0YLN	52
WA0SHE	53
W4GGU	54
WA4FGX	55

2500	
K7SQD/ W7DSJ	90
W4GGU	91
WA4FGX	92

2000	
W8RSW	117
W4GGU	118
WA4FGX	119

1500	
W8RSW	147
W4GGU	148
WA4FGX	149

1000	
K2VGR	215
W8RSW	216
W4GGU	217
WA4FGX	218

500	
WA8KPN	813
W7SE	814
W4GGU	815
WA4FGX	816

Ted Midlam, K7SQD keeps chipping away on A-1 (the hard way) and qualified for USA-CA-2500.

Frank Koval, W8RSW, who got his first USA-CA in 1962, now won 2000, 1500 and 1000, ALL A-1.

Rick Lobdell, K2VGR qualified for USA-CA-1000, ALL A-1.

Ralph McDonough, WA8KPN was sent a Mixed USA-CA-500.

Victor Seeberger, W7VSE applied for USA-CA-500, ALL A-1.

George J. Pray, WA4FGX

For some time I have wanted to be able to include a "Story" on the person qualifying for All 3079-CA in the same issue of *CQ* that I announce the qualification. Although George did not send along much data, and no photograph, I decided to go ahead anyway.

George first became interested in radio in 1936 when he built a radio into his car. Unfortunately, too often the car battery was dead from showing off the radio to the gals.

He is a licensed engineer, having completed the course at Tri State College in Angola, Indiana, and worked some 10 years as Power Plant Engineer for Consumers Power Company in Michigan.

At one time he operated as K8PQH in Lansing, Michigan.

After a four year period in the Army in WWII, George was married and they have a 17 year old daughter, of whom they are very proud.

George is presently employed as an Insurance Adjuster.

To emphasize how wonderful a bunch the County Hunters are on 14336, Geo tells how he got his last 2 counties. Jerry, W2KXL heard that Bennett County, S.D. was needed;

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*103 Whittman St., Rochelle Park, N.J. 07662.

so Jerry went way out of his way to give it to George and even sent him an air mail special delivery letter to confirm it.

When Dick, K8RNH learned that Monroe county was needed to finish all of them, he told George he would leave the first thing the following morning to work him from Monroe. So at 1729 GMT on October 13, the contact was made. In the mean time, Clay, WA8HMB told Geo that in case Dick did not make it to Monroe, he would be pleased to make a special trip to Monroe.

George is most grateful to *ALL* who have been so very cooperative and helpful—there are no other hams like the County Hunters.

Every effort will be made by Geo to attend the County Hunters Convention in Kansas City, Missouri so as to meet and thank (in person) the many many fine County Hunters.

Yes, George took me by surprise by waiting until he had all 3079 before applying for any USA-CA.

Awards

Worked All Counties in Mississippi—Award: Although this is listed as an Award, actually it is a very fine looking trophy. Issued for working all 82 Counties of Mississippi on or after September 1, 1970. Contacts may be on any amateur bands and any mode of operation. The fee is $10.00, which will cover the cost of return of your QSL cards by first class mail and a serially numbered trophy. Applicants for this award should send their QSL cards (82) and $10.00, money order or check to the Old Natchez Amateur Radio Club, P.O. Box 599, Natchez, Mississippi 39120. A copy of these rules and a listing of the 82 counties may be obtained from the Old Natchez ARC by sending a large s.a.s.e.

Mobile Amateur Radio Awards Club, Inc., Awards: Last month I promised to give some data on MARAC Awards.

Charter Membership Award: Issued free to Charter Members (Few openings left—cost $10.00, then $3.00 yearly). Charter Members count 3 points for those working for Associate Membership Award.

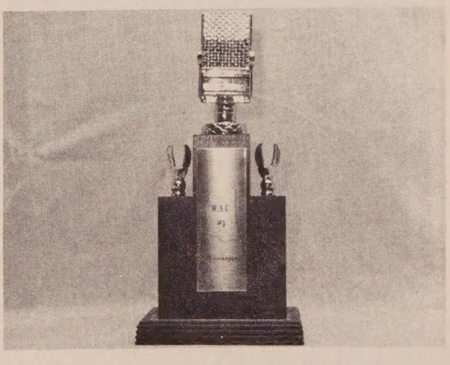
Regular Members: Cost is $3.00 per year and you receive monthly Newsletter and you count for 2 points to those working for Associate Membership Award.

Associate Award: Issued to any amateur (s.w.l. on a heard basis) for working Charter, Regular or Associate Members for a total of 100 points. Seals and ribbons for 250; 500 and 1000 points. Fee for award $1.00; seals and ribbons for s.a.s.e.

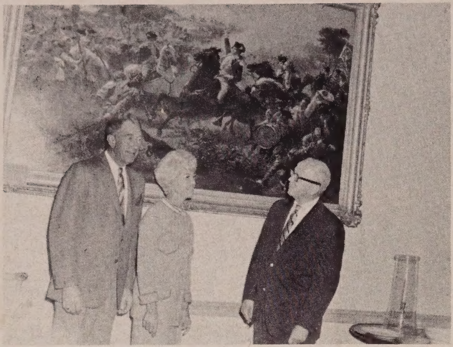
County Hunters at Knoxville-July '70.

M-50-M Award: Issued to any amateur (s.w.l. on a heard basis) for working Mobiles in all 50 states, from Fixed, Mobile, Portable, or combination of such. Basic award for 48 state side states; red seal and ribbons for 49th state; blue seal and ribbons for 50th state. Gold seal and ribbons for working all states Mobile to Mobile. Fee is $1.00, seals and ribbons for s.a.s.e.

YL Mobile Award: Issued to any amateur (s.w.l. on a heard basis) for working 5 different YLs or XYLs or combination of such while they are operating Mobile in a total of 50 different counties. They may be worked from Mobile, Fixed, Portable or combination of such. Seals and ribbons for 100, 200 counties. Trophy for 1000 counties. Basic fee $1.00, seals and ribbons for s.a.s.e. Trophy compliments of MARAC.



The Mississippi County Trophy.



Freeholder director Joseph C. Irwin and Dorothy Strauber, K2MGE listen as George J. Dittmar, Jr., past president of Monmouth County Historical Association explains painting.

MARAC DX Mobile Award: Issued for working 25 DX stations while you are operating Mobile. Seal and ribbons for 50 DX contacts and for 75 DX contacts. Trophy for 100 DX contacts, Mobile. Basic fee $1.00. Seals and ribbons for s.a.s.e. Trophy compliments of MARAC. GCR rules apply, no fee for handicapped.

Applications for all Awards should be made to MARAC Awards Chairman, W0SJE, E. J. Scroggin, 602 Jefferson, Lee's Summit, Missouri 64063.

Applications for membership in MARAC should be sent to MARAC Secretary, WA0SHE, Cleo J. Mahoney, 6001 Blue Ridge Cut Off, Raytown, Missouri 63063.

Queries on NET information, frequencies, addresses and MARAC Awards should be sent to WA4BMC, Member MARAC Awards Committee, Bertha Eggert, 1510-17th Avenue North, Lake Worth, Florida 33460.

Notes

In November *CQ,* I was pleased to use the Story of the Independent County Hunter Convention held in Knoxville, Tennessee 3-5 July. Some seventy County Hunters attended and I am happy to display a photograph of them.

Congratulations to Fred Hock, WA3HDU for being #1 Mobile qualifier for the Australian *Cook Award.* In approximately 2 months while Mobiling during his 90 minute round trip to work, he was able to qualify by working the needed 50 different "AX" stations. (This AWARD was described and fotoed in March '70 *CQ*).

The Board of Freeholders of Monmouth County, N.J. have made their County the first in the state to offer local amateurs free QSL cards, symbolic of the area as a crucial battleground of the American Revolution. Recipients of the QSL card will be informed or reminded that the Battle of Monmouth was fought in 1778 in the fields around this county seat. It shows a full color reproduction of the 1857 oil painting, "Washington Rallying the Troops of Monmouth" owned by David Leavitt of Great Barrington, Mass. and handed down through the generations of his family and in 1937 donated to the Monmouth County Historical Association.

There are some 1200 amateurs in Monmouth County, including Dorothy Strauber, K2MGE, who helped inspire the QSL idea. Dorothy is well known to *CQ* readers for her famous SSB COLUMN of a few years back.

Monmouth County Amateurs should make their requests for QSL cards to the Department of Promotion and Public Information, Hall of Records, Jane Hollander, Director, Freehold, N.J. 07728.

Hope Santa Claus was good to YOU and YOURS and that we will all have a wonderful 1971—hamwise and otherwise. How was your month? 73, Ed., W2GT.

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Propagation

BY GEORGE JACOBS,* W3ASK

THE sunspot cycle continues to remain at a practically constant level!

The Swiss Federal Observatory reports a monthly mean sunspot number of 99 for September, 1970. This results in a smoothed sunspot number of 106 centered on March, 1970. For the one-year period between April, 1969 and March, 1970, the sunspot cycle remained practically constant at a level of 106. For an in-depth analysis of the present sunspot cycle and a solar and propagation for the New Year see, "Sunspot Cycle 20—Progress 1970; Prediction 1971", appearing elsewhere in this issue of *CQ*.

Excellent DX propagation conditions are forecast for both 10 and 15 meters during January. Both bands are expected to open to most areas of the world sometime during the daylight hours, often with exceptionally strong signal levels. Excellent short-skip openings are also forecast for 10 meters during the daylight hours, between distances of approximately 1200 to 2300 miles. Similar short-skip conditions are predicted for 15 meters from shortly after sunrise through the early evening hours, for distances between approximately 1000 and 2300 miles.

Excellent DX and short-skip propagation conditions are forecast for 20 meters during the month. DX openings should peak shortly after sunrise and again during the late afternoon and early evening hours. For short-skip openings less than 1000 miles, conditions should be optimum from mid-morning through the late afternoon hours; for openings between 1000 and 2300 miles, optimum conditions are expected during the afternoon and early evening hours. Frequent DX and short-skip openings should also be possible on this band during the hours of darkness.

Good DX propagation conditions are forecast for 40 meters during January, with openings expected to many areas of the world from shortly after sundown, through the hours of darkness, and until shortly after sunrise, local time. During the daylight hours, short-skip conditions should be optimum for openings between 100 and 600 miles. During the late afternoon skip should lengthen, and by nightfall conditions should be optimum for short-skip openings between distances of approximately 800 and 2300 miles.

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for January, 1971

	Forecast Rating & Quality			
Days	(2)	(1)	(4)	(3)
Above Normal: 2, 4-5, 18, 22, 30.	B	B-C	A	A-B
Normal: 1, 3, 6, 11-12, 16-17, 19-21, 23-24, 27-29, 31.	C	D	A-B	B
Below Normal: 7, 9-10, 13, 15, 25-26.	D	E	B-C	C-D
Disturbed: 8, 14.	E	E	C-D	D-E

HOW TO USE THESE CHARTS

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 2 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parenthesis at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating high than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meaning: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak and considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 800 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss reception will become poorer by one level.

5—Local standard Time for these predictions is based on the 24-hour system.

6—These Propagation Charts are valid through Mar. 15, 1971. These Charts are prepared from basic propagation, data published monthly by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado.

Fairly good 80 meter DX propagation conditions are forecast for January, with the band expected to open to many parts of the world during the hours of darkness and sunrise period. During the daylight hours, conditions should be optimum for short-skip openings between approximately 50 and 250 miles. During the late afternoon and early evening hours the skip should lengthen, with conditions optimum for openings between 250 and 1500 miles, and by nightfall good openings up to and beyond 2300 miles should be possible.

---

*11307 Clara Street, Silver Spring, Md. 20902.

Some fairly good 160 meter DX openings should also be possible during January. Optimum times are the hours of darkness and the sunrise periods, especially when static levels are low. Frequent short-skip openings are also forecast during the hours of darkness, for distances up to approximately 1300 miles. Less frequent openings should be possible for greater distances up to the short-skip limit of 2300 miles.

To sum up, January looks like a month of fairly good to excellent short-skip and DX propagation conditions on almost all of the h.f. amateur bands. Atmospheric noise levels (static) should be at their lowest levels of the year in the northern hemisphere, and signals during many openings should be exceptionally strong.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the United States for openings between 50 and 2300 miles. Special prediction charts centered on Hawaii and Alaska also appear in this month's column. These Charts are valid through March 15, 1971.

The maximum distance possible, under normal conditions, for one-hop, short-skip propagation is 2300 miles. For opening beyond this distance, refer to the DX Propagation Charts which appeared in last month's column.

This month's Charts are based on a predicted smoothed sunspot number of 92, centered on January, 1971.

V.h.f. Inonspheric Openings

An occasional trans-continental F-2 layer 6 meter opening may be possible during January, as well as an occasional opening between Hawaii and the mainland, and between the USA and Central and South America. The most likely times for F-2 layer 6 meter openings are from an hour or so before noon, through the early afternoon hours.

January is a poor month for trans-equatorial scatter propagation, but an occasional TE opening between the southern regions of the USA nd South America may be possible between 8 and 11 P.M., local time.

Some fairly good meteor-scatter openings should be possible on the v.h.f. bands during January 3-4, when the *Quadrantids* meteor shower is expected to peak. While of relatively short duration, the *Quadrantids* is expected to be one of the most intense showers that will occur during 1971. During its peak, as many as 30 to 40 meteors should enter the earth's atmosphere each hour.

Relatively little sporadic-E or auroral activity is expected during January. Some v.h.f. openings due to these propagation phenomena are likely to occur, however, when h.f. propagation conditions are below normal or disturbed. Check the "Last Minute Forecast" appearing at the beginning of this column for those days that are expected to be in these categories during the month.

CQ Short-Skip Propagation Chart
January 15—March 15, 1971
Local Standard Time at Path Mid-Point

(24-Hour Time System)

Distance From Transmitter (Miles)

Band (Meters)	*50-250*	*250-750*	*750-1300*	*1300-2300*
10	*Nil*	*Nil*	07-08 (0-1) 08-09 (0-2) 09-10 (0-3) 10-12 (0-4) 12-15 (0-3) 15-17 (0-2) 17-18 (0-1)	07-08 (1) 08-09 (2-3) 09-10 (3-4) 10-12 (4) 12-15 (3-4) 15-16 (2-4) 16-17 (2-3) 17-18 (1-2) 18-19 (0-2) 19-20 (0-1)
15	*Nil*	07-08 (0-1) 08-15 (0-2) 15-17 (0-1)	06-07 (0-1) 07-08 (1-2) 08-11 (2-3) 11-15 (2-4) 15-16 (1-4) 16-17 (1-3) 17-19 (0-2) 19-20 (0-1)	06-07 (1) 07-08 (2) 08-09 (3) 09-11 (3-4) 11-16 (4) 16-17 (3-4) 17-18 (2-4) 18-19 (2-3) 19-20 (1-2) 20-21 (0-1)
20	09-11 (0-1) 11-14 (1-2) 14-16 (0-1)	07-09 (0-2) 09-11 (1-4) 11-14 (2-4) 14-16 (1-4) 16-19 (0-3) 19-20 (0-2 20-07 (0-1)	07-08 (2) 08-09 (2-3) 09-16 (4) 16-19 (3-4) 19-20 (2-3) 20-22 (1-3) 22-00 (1-2) 00-06 (1) 06-07 (1-2)	06-07 (2) 07-08 (2-3) 08-09 (3-4) 09-10 (4) 10-14 (4-3) 14-19 (4) 19-21 (3-4) 21-22 (3) 22-00 (2) 00-03 (1-2) 03-06 (1)

40	07-08 (0-2) 08-09 (1-3) 09-10 (2-4) 10-16 (4) 16-18 (2-4) 18-19 (2-3) 19-21 (1-2) 21-07 (0-1)	07-08 (2) 08-09 (3) 09-11 (4-3) 11-15 (4-2) 15-16 (4-3) 16-18 (4) 18-19 (3-4) 19-21 (2-4) 21-01 (1-3) 01-07 (1-2)	07-08 (2) 08-11 (3-1) 11-15 (2-1) 15-16 (3-2) 16-17 (4-2) 17-18 (4-3) 18-21 (4) 21-01 (3-4) 01-04 (2-4) 04-07 (2-3)	07-08 (2-1) 08-15 (1-0) 15-17 (2-1) 17-18 (3-2) 18-20 (4-3) 20-04 (4) 04-05 (3) 05-07 (3-2)
80	07-08 (2-3) 08-10 (3-4) 10-15 (4-3) 15-21 (4) 21-00 (3-4) 00-04 (2-3) 04-07 (1-2)	07-08 (3) 08-09 (4-2) 09-10 (4-1) 10-15 (3-1) 15-16 (4-1) 16-18 (4-2) 18-00 (4) 00-04 (3-4) 04-07 (2-3)	07-08 (3-1) 08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-04 (4) 04-06 (3) 06-07 (3-2)	07-08 (1-0 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-03 (4) 03-04 (4-3) 04-05 (3) 05-06 (3-2) 06-07 (2-1)
160	09-17 (1-0) 17-19 (3-2) 19-05 (4) 05-07 (3) 07-09 (2-1)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-1) 07-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-1) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (1)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2) 06-07 (1-0)

ALASKA

Openings Given in GMT†

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	19-20 (1) 20-22 (2) 22-23 (1)	16-17 (1) 17-21 (2) 21-23 (3) 23-00 (2) 00-02 (1)	11-15 (1) 15-17 (2) 17-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	04-13 (1) 07-12 (1)*
Central USA	19-21 (1) 21-00 (2) 00-01 (1)	17-18 (1) 18-20 (2) 20-22 (3) 22-23 (4) 23-01 (3) 01-02 (2) 02-04 (1)	11-16 (1) 16-18 (2) 18-23 (1) 23-01 (2) 01-04 (3) 04-05 (2) 05-06 (1)	05-14 (1) 08-13 (1)*
Western USA	19-20 (1) 20-21 (2) 21-22 (3) 22-00 (4) 00-01 (3) 01-02 (2) 02-03 (1)	17-18 (1) 18-19 (2) 19-23 (3) 23-01 (4) 01-02 (3) 02-03 (2) 03-04 (1)	11-17 (1) 17-18 (2) 18-20 (3) 20-01 (2) 01-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-07 (1)	04-05 (1) 05-12 (2) 12-15 (1) 15-16 (2) 16-17 (1) 05-12 (1)* 12-15 (2)* 15-17 (1)*

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (act of October 23, 1962; Section 4369, title 39, United States Code) (1) Date of Filing– September 30, 1970; (2) Title of Publication– CQ THE RADIO AMATEUR'S JOURNAL; (3) Frequency of Issue– Monthly; (4) Location of Known Office of Publication– 14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050; (5) Location of the Headquarters or General Business Offices of the Publishers– 14 Vanderventer Avenue, Port Washington, County of Nassau, New York 11050; (6) Names and Addresses of Publisher, Editor and Managing Editor: Publisher– Richard A. Cowan, 32 Burham Street, Smithtown, New York; Editor– Richard A. Ross, 95 Norwood Avenue, Northport, New York; Managing Editor– Alan M. Dorhoffer, 20 Kaywood Road, Port Washington, New York; (7) Owner– (If owned by a corporation, its name and address must be stated and also immediatley thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)– Sanford R. Cowan, 500 Bayview Drive, North Miami Beach, Florida; (8) Known Bondholders, Mortgagees, and other Security Holders Owning or Holding 1 percent or More of Total Amount of Bonds, Mortgages or other Securities (if there are none, so state) –NONE; (9) Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs shown the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation. (10) Extent and Nature of Circulation – Average No. Copies Each Issue During Preceding 12 months, Single Issue Nearest to Filing Date: (A) Average No. Copies Each Issue During Preceding 12 Months– Total No. Copies Printed (Net Press Run) – 69,527 (B) Paid Circulation 1. Sales Through Dealers and Carriers, Street Vendors and Counter Sales – 29,501; Mail Subscriptions – 38,182; (C) Total Paid Circulation – 67,683; (D) Free Distribution (including samples) By Mail, Carrier or Other Means – 805; (E) Total Distribution (Sum of C and D) – 68,488; (F) Office Use, Left-over, Unaccounted, Spoiled After Printing – 1,039; (G) Total (Sum of E and F – should equal net press run shown in A) – 69,527. Single Issue Nearest to Filing Date: (A) Total No. Copies Printed (Net Press Run) – 75,883; (B) Paid Circulation 1. Sales Through Dealers and Carriers, Street Vendors and Counter Sales – 29,704, 2. Mail Subscriptions – 40,966; (C) Total Paid Circulation – 70,670; (D) Free Distribution (including samples) By Mail, Carrier or Other Means – 1,428; (E) Total Distribution (Sum of C and D) – 72,098; (F) Office Use, Left-over, Unaccounted, Spoiled After Printed – 3,785; (G) Total (Sum of E and F – should equal net press run shown in A) – 75,883. I certify that the statements made by me above are correct and complete. (Signed) Richard A. Cowan, Publisher.

HAWAII

Openings Given in Hawaiian Standard Time‡

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	07-08 (1) 08-11 (2) 11-13 (3) 13-14 (2) 14-16 (1)	06-07 (1) 07-12 (2) 12-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	05-07 (2) 07-13 (1) 13-16 (2) 16-18 (3) 18-20 (4) 20-00 (3) 00-02 (2) 02-05 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-03 (2) 03-04 (1) 19-21 (1)* 21-01 (2)* 01-03 (1)*
Central USA	07-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-09 (3) 09-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1)	02-04 (2) 04-06 (1) 06-08 (3) 08-10 (2) 10-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-20 (3) 20-21 (2) 21-02 (1)	18-19 (1) 19-20 (2) 20-03 (3) 03-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)*
Western USA	06-08 (1) 08-09 (2) 09-13 (4) 13-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-09 (3) 09-16 (4) 16-17 (3) 17-18 (2) 18-20 (1)	05-07 (2) 07-10 (4) 10-14 (3) 14-18 (4) 18-19 (3) 19-21 (2) 21-05 (1)	17-18 (1) 18-19 (2) 19-02 (4) 02-04 (3) 04-06 (2) 06-07 (1) 19-20 (1)* 20-22 (2)* 22-04 (3)* 04-05 (2)* 05-07 (1)*

*Indicates predicted 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2) or higher.

†To convert to Local Standard Time in Alaska, *subtract* 8 hours from GMT in the Pacific Standard Time Zone; 9 hours in the Yukon Zone; and 10 hours in the Alaskan Standard Time Zone. In other USA Time Zones subtract 5 hours from GMT in the EST Zone; 6 hours in the CST Zone and 7 hours in the MST Zone. For example, at 20 GMT it is 12 Noon in Juneau and 15 or 3 P.M. in N.Y.C.

‡To convert from HST shown in the Chart to Local Standard Time in other USA Time Zones, *add* 2 hours in the PST Zone, 3 hours in the MST Zone; 4 hours in the CST Zone; and 5 hours in the EST Zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 Noon in Honolulu, it is 14 or 2 P.M. in Los Angeles; 17 or 5 P.M. in Washington, D.C.; and 22 GMT.

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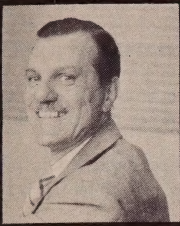


Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

Jan.	9-10	ARRL VHF SS
Jan.	16-17	Louisiana QSO Party
Jan.	23-24	Arkansas QSO Party
Jan.	30-31	French C.W. Contest
Jan.	**30-31**	**CQ WW DX 160 Contest**
Feb.	6-7	ARRL DX Phone Contest
Feb.	13-14	QCWA QSO Party
Feb.	20-21	ARRL DX C.W. Contest
Feb.	27-28	French Phone Contest
Feb.	27-28	YL/OM Phone Contest
Mar.	6-7	ARRL DX Phone Contest
Mar.	13-14	YL/OM C.W. Contest
Mar.	20-21	ARRL DX C.W. Contest
Mar.	**27-28**	**CQ WW WPX SSB Contest**
*Apr.	3-4	SP DX Contest
*Apr.	17-18	Helvetia XXII Contest
*Apr.	24-25	PACC DX Contest
May	21-23	YL Inter. SSBers QSO Party

*Tentative date, not official.

Louisiana QSO Party

Starts: 1800 GMT Saturday, January, 16
Ends: 2200 GMT Sunday, January 17

This is the 6th annual party sponsored by the Lafayette ARC. The same station may be worked on each band, c.w. and phone, for QSO points. Louisiana stations may also work each other for QSO points.

Exchange: QSO nr., RS/RST and QTH. Parish for La., state, province or country for others.

Scoring: For all stations, 1 point per QSO. La. multiply total by number of states, VE provinces and DX countries worked. All others use La. parishes for their multiplier. (max. 64)

Frequencies: C.W.–3600, 7075, 14075, 21075, 28100. Phone: 3910, 7260, 14300, 21400, 28700.

Awards: Certificates to winners in each state, VE call area and each country. And 1st, 2nd and 3rd place winners in Louisana. The W5PM Trophy goes to the top La. winner. Portable stations operating from rare parishes will be listed in a separate catagory with awards including a Trophy. (A min. score of 50 points for U.S. and 25 points for DX required)

Mailing deadline Feb. 6th to: Lafayette ARC, c/o Danny Griffith, K5ARH, 123 Normandy Road, Lafayette, Louisiana 70501. Include a s.a.s.e. if results desired.

Arkansas QSO Party

Starts: 2200 GMT Saturday, January 23
Ends: 0400 GMT Monday, January 25

The North Arkansas ARS announces its 6th annual QSO party. The same station may be worked on each band and mode for QSO credit.

Exchange: QSO nr., RS/RST and QTH. County for Ark. stations, state, province or country for all others.

Scoring: Ark. stations score 1 point per QSO, and multiply total by number of states, VE

Mr. Smith, curator of historic Ft. St. Catherine, Bermuda, locks up (L. to R.) W1NU/VP9, VP9AH, and K2RSR/VP9, operators of the club station VP9BDA, for the 24 hour Bermuda C.W. Contest period back last July. The Bermuda Government OKed the operation from this historic site with the provision that the operators be locked up overnight. The Fort is a museum and houses many rare valuable relics, including an exact replica of the British crown jewels. (Shifty looking lot aren't they?) (Photo credit: Pamela Serle, *Bermuda News*) provinces and DX countries worked.

---

*14 Sherwood Road, Stamford, Conn. 06905.

Outside stations score 5 points for each Ark. station worked and multiply total by Ark. counties worked. (max. of 75)

Frequencies: C.W.–3560, 7060, 14060, 21060, 28060. Phone–3960, 7260, 14300, 21360, 28560. Novice: 3735, 7175, 21110.

Awards: Certificates to top scorers in each state, VE province and DX country. (min. of 100 points)

Mailing deadline Feb. 9th to: North Arkansas ARS. c/o J. K. Fancher, W5WEE, 407 Skyline Terrace, Harrison, Arkansas 72601.

French DX Contest

C.W.–Jan. 30-31 **Phone**–Feb. 27-28
Starts: 1400 GMT Saturday
Ends: 2200 GMT Sunday

Complete rules in last month's CALENDAR. It's the world working the French in Europe as well their territorial territories.

Logs go to: R.E.F. Contest Committee, Boulevard de Bercy 60, 75 Paris 12, France.

ARRL DX Contest

Phone: February 6-7 and March 6-7
C.W. February 20-21 and March 20-21
Starts: 0001 GMT Saturday
Ends: 2359 GMT Sunday

This is the 37th running of this contest, so it's a marathon in more ways than one.

All the DX stations will have their beams pointing to the USA and Canada and see how many W/Ks and VEs they can knock off.

The fellows on this side will send a signal report and their state or province. The DX stations will add three digits to their signal report indicating their power.

Complete details should have appeared in the December issue of *QST*. Log forms, summary sheets and check off sheets are available from ARRL.

Address all communication to: ARRL Communications Dept. 225 Main Street, Newington, Conn. 06111.

CQ WW DX 160 C.W. Contest

Starts: 0000 GMT Saturday, January 30
7 P.M. EST Friday, January 29
Ends: 1500 GMT Sunday, January 31
10 A.M. EST Sunday, January 31

Complete rules appeared in last month's CALENDAR. This year for the first time we are offering a Plaque to the Top scorer in the contest.

Keep the "DX Window" (1825-1830) open fellows. That's where you will hear the DX stations. They will be looking for W/Ks and VEs down in the low end of the band. (1800-1805) Calling DX on frequency just does not work out on 160.

We remind the West coast boys up at the other end of the band, 2 mc, to listen down on 1.8 mc once in a while. Some of us on the East coast, as you know, are restricted to that portion of the band.

We also implore the phone boys to also keep the "DX Window" clear. It's only for one weekend out of the year fellows.

Still time to get your log sheets and Operating Regulations for 160. A large s.a.s.e. to *CQ* will do the trick.

Mailing deadline for your entries is Feb. 28th to: *CQ* 160 Contest, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050.

QCWA QSO Party

Starts: 0000 GMT Saturday, February 13
Ends: 2400 GMT Sunday, February 14

This year's party is sponsored by the Dallas Chapter of QCWA. Only contacts with other members will count for the QCWA awards.

This is primarily an activity to renew old acquaintances and see how many members you can contact. Working overseas members is incouraged.

Like last year a simple scoring system is incorporated to make it more interesting.

Exchange: QSO nr., QTH, RS/RST, name and QCWA number.

Scoring: One point for each QCWA member worked, multiplied by the sum of states, VE provinces, maritime mobiles and DX countries worked. (A member station may be worked only *once* for points, regardless of band or mode.)

Awards: The QCWA Plaque donated by Headquarters to the "Top Banana" in the Party, to be permanently retained by the member winning it three times.

Frequencies: C.W.–3580, 7080, 14080, 12080, 28080. Phone–3980, 7280, 14280, 14345, 21380, 21445, 28580. RTTY–3595/3600, 7095/7100 14080/14100, 21070/21075, 28070/28075.

Your log should read as follows: Date/time GMT, Nr. sent/rec'd, station worked, QTH, freq., signal report, name and QCWA number.

Mailing deadline March 14th to: L. F. Heithecker, W5EJ, 1409 Cooper Drive, Irving, Texas 75060.

YL-OM Contest

Phone: Feb. 27-28 **C.W.:** Mar. 13-14
Starts: 1800 GMT Saturday
Ends: 1800 GMT Sunday

It's the YL's working the OM's in this one. Use all bands, cross band or net contacts do not count.

Exchange: QSO nr., RS/RST and ARRL section or country.

Scoring: One point per contact, multiplied by total number of ARRL sections and countries worked. There is also a power multiplier of 1.25 for stations running 150 watts or less input. (300

[*Continued on page 79*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

I HAVE alluded to the R-390 series of military receivers in past columns, but have never given those wonderful big beasts their proper due. I have heard recently from several readers who think I ought to dedicate the present effort to exposition on that subject.

There are probably many amateurs and others who have heard the R-390 mentioned in hushed tones, without really learning what it is, or why it has come to be regarded as the *ne plus ultra* in high frequency general coverage receivers. This column then will endeavor to give a few pertinent facts about a series of receivers that are top status symbols in the most sophisticated radio shacks.

The R-390 is a general coverage receiver, reaching from 500 kilocycles to 32 megacycles in 32 tuning bands. It weighs between 84 and 88 pounds, depending upon model, and is normally mounted in a 19 inch relay rack, occupying 10½ inches of rack height. In the words of the military description, the R-390 is "a high performance, exceptionally stable, general purpose superhetrodyne receiver for use in fixed or mobile applications. It provides reception of continuous wave, modulated continuous wave, voice, and frequency-shifted keyed signals."

Variations of the 390 type include the R-389, which covers from 15 kc to 1,500 kc in one band, the straight R-390, the R-390A, which has excellent mechanical intermediate-frequency filters giving optimum bandpass shapes varying from 100 cps, through 1, 2, 4, 8 and 16 kc; the R-391, a variant of the 390 with 24 volt autotune, and the R-392, a more compact, ruggedized R-390 designed for use in jeeps and other vehicles, and operated off 24 volt d.c. power.

The straight R-390 set is the most common, and, lacking the mechanical filters, is usually slightly cheaper in surplus than the -A model which is the highest-priced, listing at all the way to $2,000 in recent years, even though the U.S. Army paid less than half that for the units new in quantity. The slightly less-common R-389 and 392 sets have varied widely in price and availability.

Manuals are: R-389, TM 11-855; R-390, TM 11-856; R-390-A, TM 11-856A; R-391, TM 11-863; R-392, TM 11-858.

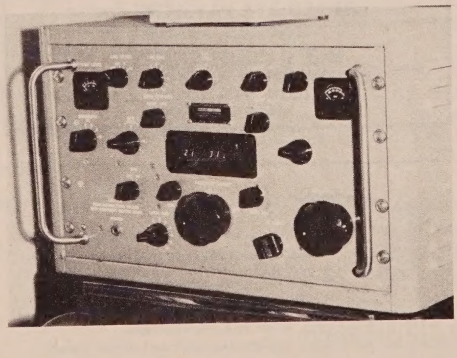
All five designs offer 455 kc i.f. outputs for associated radioteletype demodulators (CV-116) and s.s.b. converters (CV-157, CV-191) which were used by the military in many applications.

The R-391 uses power supply PP-629/URR to drive the autotune section, which may be ignored if manually operated tuning is desired.

Most of the R-390 series were produced by Collins Radio Co., and the design is a logical extension, much refined, of the familiar R-388 (51J4) Collins receiver. Many were assembled, using Collins parts, by Motorola. The tuning uses complex racks to move slugs in the i.f. transformers and r.f. coils, all coupled through a gear arrangement to a five-digit Root-type digital counter. With its inherent tuning accuracy and resettability to within 300 cps, you can merely dial up your frequency and rely on finding a signal well within the range of the b.f.o. tuning.

The digital tuning is a nice touch, but the R-390's long suit is stability. Most 390's will sit on a channel like a very solid rock, month in and month out, without requiring use of the internal oscillator oven unless the ambient temperature varies widely. I have found no detectable variations between Collins and Motorola 390's. They look identical and perform identically, with only the nameplate to differentiate the manufacturers.

There may be better recivers for specialized purposes, and the current Collins 51S1



The R-390A/URR receiver.

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general coverage set is the solid-state successor to the 390, with at least the usual pluses and minuses of transistors, but for most amateurs and s.w.l.s, the R-390 represents the top available receiver.

There are a few points in the 390 that could be said to be minor faults—the tuning gears are a little stiff, and "R-390-wrist" is a common ailment after tuning around for an evening with one of these receivers. In fact, some of us have a Hammarlund SP-600 in the rack next to the 390 for searching the bands. When something interesting turns up on the spin-tuning SP-600 you can zero in with the 390.

The gearing is *not* designed for fast shifting from one end of the dial to the other, in fact I have seen R-390's used by the Environmental Science Services Administration (ESSA) Central Propagation Radio Observatory, which were simply worn out from too much tuning, to say nothing of the operators. In later digital-tuning equipment phase-locked frequency synthesis is used, doing away with all those racks and gears. This is certainly one advantage of solid state, with a roomful of tube circuits packed into integrated circuit packs that need no mechanical drive.

The basic circuits of the R-390 and R-390-A are similar, but not identical. In addition to the filter differences (the 390 uses crystal filters) there are several other variations which, for example, make it impossible to merely remove a 390 i.f. section and insert the 390-A module with its mechanical filters. Though the two look similar, few of the parts will actually interchange. The 390 has a reputation for better sensitivity, one that I cannot document, although it *seems* to me that the 390 is a little "hotter" than its later brother.

My R-390-A has never showed proper S-meter operation, and I did burn out (for reasons still unknown) one of the mechanical filters. The replacement has had no trouble, so it may have been a bad filter.

The R-390 is not the ultimate receiver—there are laboratory receivers that are more stable—if you can measure a cycle or two a day of "drift." There are specialized receivers that are more sensitive, particularly those used in satellite tracking, but not generally available in surplus or commercial channels.

The most glaring "fault" is the lack of a s.s.b. detector in the design, but the military provided outboard s.s.b. and RTTY units and

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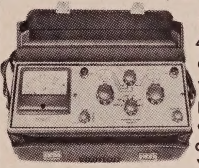

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no product detector was needed in the basic set. A very good product detector circuit was offered in *CQ* in January, 1965, page 37, that may be incorporated in the 390-A if that is desired.

The CV-157 s.s.b. unit is a 44-tube beast, high in price and exceedingly complex, and the CV-116 RTTY Demodulator is also a large unit, costly, and not as inherently excellent as many amateur RTTY designs such as the TT/L-2.

But in no way do I want to sound as though the R-390 is anything but a most excellent general coverage receiver. It has the sensitivity and stability for the most serious radio work, amateur, commercial, or s.w.l.

Manuals on the R-390 series are currently available from Sam Consalvo, 4905 Roanne Dr., Oxon Hill, Maryland.

Contest Calendar [*from page 76*]

watts p.e.p.) Multiply score by above factor.

The same station may be worked only *once* for QSO or multiplier credit.

Phone and c.w. are considered separate contests and require separate logs.

Awards: Certificates to the highest scoring YL and OM in each ARRL section and country. There are also 4 Trophies for the Top YL and OM in the contest, both on phone and c.w.

You are expected to score your log and sign the usual declaration that all rules and regulations have been observed.

Mailing deadline is April 4th and go to: Mae Hipp, K7QGO, 5655 Yukon Drive, Sparks, Nevada 89431.

Editor's Notes

For the past few years we have found it more and more difficult to pick a firm date for our WPX SSB Contest.

Trying to avoid the Easter week-end and find a clear spot in an already over-crowded Calendar was almost impossible.

A little research shows the last week-end in March free of any major contest activity and with no Easter Holiday for the next few years. We have therefore picked the last full week-end in March as the permanent date of our WW WPX SSB Contest.

There is one disadvantage in that is closely follows the ARRL DX contest, however their last week-end is a c.w. affair so it should not be too objectionable. Maybe the ARRL will eventually cut their Marathon down to single week-ends.

Rules will be the same as in previous years, with the compulsory rest period for single operator stations, and the new double QSO points on 40 and 80 that was incorporated last year, which proved very popular.

Results of the 1969 WPX SSB Contest will be announced in next month's issue.

73 for now, Frank, W1WY

1970 Bermuda Contest Results

Top scorers in their respective areas: Phone—Hal Perkins, G3NMH; Stu Meyer, W2GHK/4; and Vivian Siddle, VP9GD.

C.W.—Rusty Russell, G5WP; Art Wildblood, W2DXL and Jim Sayer, VP9BY.

Certificate winners in North America: Phone—W2GHK/4, W1NU, VE3CBG, WB8ABN, W2-FPD, W0AIH, VE1EK, VO1CA, K9VQK, WA7GQI.

C.W.—W2DXL, W3UV, W4UQ, W5KC, WA8-QIY, W1TW, VE3BMV, VO1CA, VE1EK/1, W7VSE, W9LNQ, WA6LLY, VE2BGF.

The Top Scorers were honored and received their awards at a banquet given by the Bermuda Radio Society during the week of October 18-24.

Looking After the Store [*from page 28*]

JY1 didn't show that night, having, maybe, other things to do.

For the next 5 days things were quiet, except for reporters camped on the doorstep, in shifts, like bailiffs; except for the constant ringing of the phone; except for a direct, telephoned interview from *Kol Israel* in Tel Aviv; and except for the irate Editor who didn't give a damm whether my son *was* the King or Jordan; where were those 2,000 words I'd promised about midiskirts?

From Jordan there was silence, except for spasmodic, fragmentary bits of disturbing rumour.

On September 23rd the B.B.C. asked could they send a film team down for a news program called *Nationwide*. We thought the story had gone cold by then and so did the team. They'd been working since dawn, on a murder case, and ours was small stuff, just a routine, also-ran assignment. There was a director, a cameraman and four technicians.

They took the doors off their hinges and emptied the dining room and set up their lights and cameras. Only one newspaperman was there. Laurie sat at the rig, spinning dials, while the cameraman adjusted his gear. The B.B.C. interviewer and I talked shop. Routine, rather dull, *except the King came too!*

"He's on!" Laurie said, quietly.

The director went detergent-white. This was the biggest scoop he had ever scooped. "Are you ready to roll?" he asked his cameraman, but the cameraman was rolling, filming everything that happened. The newsman was heading already for the phone.

And the Circus came to Town again.

There were despatch riders and reporters from all the papers again, reps from the world's press agencies, from German, French and Swiss papers. The neighbors' homes were invaded at midnight by desperate pressmen, avid to get at a vacant phone.

Even for top professionals like the B.B.C. team, this had been an exhausting experience. Hard on the heels of professional triumph came professional hunger. They stripped the frig, ate all the cheese, cold meat and fruit they could find and all the bread I could borrow from neighbors at 1 in the morning. They drank gallons of tea and coffee and quite a lot of *Black Label*. It was a wonderful party.

Next day Laurie went to the Independent Television studio, to tape a face-to-face interview for the Eamonn Andrews show. It was transmitted at the same time as the completely uncut *Nationwide* film, so we watched on two TV sets together, like at a tennis tournament.

And that's about it. From then on, as the situation in Amman clarified and some communication was restored, we began to sink back into the anonymity from whence we came. There remained only the regular contacts between G3UML and the JY1.

The rest of the amateur world had behaved beautifully during the emergency, QRX-ing like mad whilst Hussein spoke to his friends, Mary-Anne Crider and Laurie. Knowing radio amateurs as I do, knowing the best and, Lord love us, the worst of them, their tact and discretion came as a pleasant surprise!

Now, as danger receded and Hussein could once more talk to his wife in London through normal channels, he began to relax with his amateur radio again and to talk to as many amateurs as could crowd onto the frequency. The combination of the only JY station and the King-at-the-mike was irresistible to the kilowatt boys and occasionally His Majesty had to go all Royal on them and whip them into a fawning queue.

"*Shut up*" he snapped at a bumptious W6, as he carefully spelt out his name and QTH to an ON5 who didn't seem to know what had been going on lately! You could hear the laugh in the King's voice.

It was noticeable that those who responded most joyously to these Royal commands were

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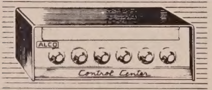

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Then we had an idea that appealed to Hussein. Princess Muna, his wife, held the only other amateur callsign issued in Jordan, JY2. Why not fix up a rig in her London apartment, so they could talk direct? Urgent negotiations were put in hand with the Ministry of Posts and Telecommunications, to arrange her reciprocal license. We located a tame dealer with a spare beam and planned to install our mobile rig in the Princess's home and show her how to use it.

Hussein was delighted with the plans, as any amateur would be, and began telling people he was hoping to talk to Muna by amateur radio.

The best-laid plans of mice, men and kings go oft astray. The Princess said she preferred to talk to her husband over the phone.

And if that's not a typical radio amateur's wife, I don't know what is. ■

FM [*from page 34*]

(usually 70 to 200 c.p.s.) is transmitted with the regular audio information (voice). This tone is decoded by a sensitive reed or other tuned circuit which allows the squelch of the receiver to open and the voice message to come through. Transmitters with tones of another frequency or no tone at all will not be received. The tone is normally filtered out of the receiver speaker audio to avoid an annoying hum. However, the higher frequency tones may be heard although they are at a very low level in comparison to the desired audio. Such tone control is often used in commercial radio systems to avoid hearing other stations on the channel during standby periods. When a transmission is desired to a unit using the same tone frequency, the channel is monitored to avoid interferring with other stations. This is accomplished by circuitry in the receiver which disables the TONE CONTROL. Some amateur repeaters have gone to this type of control to avoid either interference by stations in other areas or in order to create a "closed" or private repeater.

Finale

This concludes the first f.m. column. Everyone chip in with news, information, tech tips, etc. to keep the column rolling. Any suggestions, format changes, etc. will be appreciated. Next Month: A major manufacturer is releasing f.m. equipment to amateurs!! Who, what, where, and how. ■

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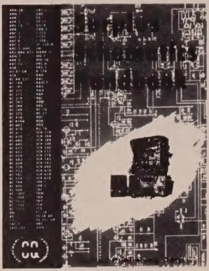

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DX [*from page 62*]

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9Q5JD–To ON5IU.
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73, John, K4IIF.

Crystal Calibrator [*from page 40*]

"Simple Crystal Calibrator Using ICs"
(H & K), p. 43, *QST*, Jan. 1968
"Frequency Divider for 100 khz Calibrators"
(G & G), p. 26, *QST*, Nov, 1968
"Mini-spotter Frequency Checker"
W7OE, p. 48, *hr*, May 1968
"Calibrators and Counters"
K6KA, p. 41, *hr*, Nov. 1968
"Amateur Frequency Measurements"
K6KA, p. 53, *hr, Oct. 1968*
"Plug-in IC Calibrator"
K6KA, p. 22, *hr*, Mar. 1969
"100 khz Thin-line Pulse Generator"
Ashe, p. 24, *73*, Feb. 1968
"100 Khz Marker Generator"
Davey, p. 24, *73*, Apr. 1969
"The Ball of Wax–A Calibrator"
Olsen, p. 84, *73*, Nov. 1969
"Universal Dual-Frequency Crystal Calibrator"
Shultz, p. 58, *73*, Dec. 1969
"A Simple Crystal Tester-Calibrator"
Robbins, p. 20, *QST*, Feb. 1970

Editors & Engineers Radio Handbook,
(any edition).
The Radio Amateur's Handbook,
(any edition).
"A Digitally Divided Frequency Standard for Lab or Receiver Calibrator"
Nusbaum, p. 40, *CQ,* Dec. 1970

Mono Loop Quad [*from page 43*]

band is found only at the small loop, and the 14 mc band only at the large loop. See Table I. The two pairs of frequencies at the upper and lower quad element corners should be identical to ensure symetry.

The resonances of the radiator element are where the s.w.r. is at its lowest. If, for instance, the desired operating frequency is 14.25 mc, and resonance is found at 14.0 mc, the quad loop or the large hairpin loop must be shortened. Do this in steps of 4″ total wire length by folding over the hairpin loops or twisting loop ends as shown in fig. 3. Loops can be trimmed later. See Table II.

Reducing the size of the capacitors will have similar effects. At 28 mc a 2 mmf capacity change can alter the resonant frequency by over 0.5 mc. Pull back the braid on the coax capacitors in 1/2″ steps. Commence adjustment at 20 m.; then 15 m.; then 10 m.

Adjust the reflector in the same manner. If a third element (director) is used, the frequencies shown in Table I would be about 5% higher than those of the driver element. Finally, using a test dipole, a field strength meter and a signal source, adjust the antenna for deepest back null or strongest forward lobe, whichever is considered more important. Do this by setting both the driver element and reflector vertically at the proper spacing and tuning the reflector. S.w.r. will also improve at the same time. An s.w.r. of 1.5:1 is possible at all operating frequencies; less is of no consequence. S.w.r. at band edges is still under 2:1.

The mono loop quad has little radiation to the ground or to high elevations. The side nulls of the horizontal pattern are over 30 db deep and can be used to cut out local QRM. Local installations (power lines, etc.) change the radiation pattern and reduce directivity.

Performance

There is certainly no reason to be ashamed of the signal put out by the Mono-Loop Cubical Quad. DX sked partners have been more than surprised at the difference between the quad and the three element tri-band beams used for the last 12 years. DL stations I have worked over 100 times on 20 m. are giving two S-units more on a signal report, and no longer complain that local QRM causes trouble. While receiving, I frequently have to turn back the r.f. gain to avoid overload.

Something has been done wrong if this quad is no better than three element tri-band yagi, but fair warning: the local mates will complain about cross modulation. ■

Sunspot Cycle [*from page 46*]

year, 1971 is expected to be another *good* year for DX conditions.

The moderate level of solar activity expected during 1971 should result in continued good openings on the 10 meter to most areas of the world during the daylight hours of the fall, winter and spring months.[2] The band is likely to open somewhat less frequently, however, than during the previous three years. Excellent DX conditions are expected for 15 meters from shortly after sunrise through at least the early evening hours during almost every month of the year. DX conditions, especially on east-west paths, may slump somewhat during the summer months. Twenty meters should continue to be a year-round DX band from sunrise through the late evening hours. From spring through the fall months it may also be the optimum band during the hours of darkness.

Not much change is expected on 40, 80 or 160 meters during 1971. Forty meters should open for DX shortly before sunset and remain open through the hours of darkness and until shortly after sunrise. Good DX propagation should be possible to most areas of the world sometime during this period, especially during the fall, winter and early spring months. Optimum nighttime DX propagation conditions are expected on 40 meters during the winter months. Eighty meter openings should also be possible to most areas of the world during the hours of darkness and the sunrise period. Some fairly good DX openings on 160 meters can be expected during the hours of darkness and the sunrise period during all but the summer months.

In summary, 1971 should go down as another good year for h.f. propagations, although there may be a bit fewer openings on 10 meters and a summer slump on 15 meters.

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[2] For a more detailed band-by-band prediction see, "A Seven Year Propagation Forecast For The Amateur DX Bands", Jacobs, G. and Leinwoll, S., *CQ,* Nov. 1969, p. 52.

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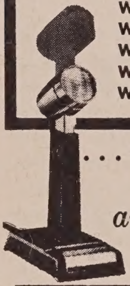

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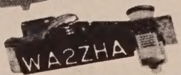

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CQ Reviews: Curtis [*from page 56*]

and case in colors and texture to match Collins, Drake, Galaxy, Heath and Swan gear. The size of the unit is 3⅛″ x 7¼″ x 5½″ (H.W.D.) and it weighs 2½ lbs.

Paddles

Suggested paddle keys to go along with these keyers are the Brown Brothers Machine Co[2]. Models BTL or CTL. These are dual-paddle jobs for independent dots and dashes. They are beautifully finished with chrome plating. Quarter inch silver contacts in the levers face 3/16″ silver contacts on chrome-plated brass contact screws. The only needed contact adjustment is for spacing to suit the operator. The spring tension also is adjustable as are the pivots, if needed to remove any play.

The frame is finished in baked black-wrinkle enamel and is mounted on a similarly-finished heavy metal base size 3½″ x 4½″. Paddles are red plastic.

The model CTL also has a straight key mounted on the base. This key, too, is fully adjustable, is chrome-finished, has 1/4″ silver contacts and is equipped with a Navy-type knob. Terminal connections on the base are arranged so that the straight key may be operated in conjunction with the keyer or independently. The complete setup thus will provide automatic, semi-automatic and straight-keying. The straight key also may be connected to enable the automatic message generator to be activated simply by tapping the key momentarily.

The Curtis Electro Devices Iambic Deluxe Electronic Fists are priced as follows: EK-38, $82.95 ($72.95 kit); EK-39, $97.95 ($87.95 kit); EK-39M, $179.95, less custom-tailored plug-in memory which is ordered directly from the factory as per customer's message-instructions. The memory is priced at $59.95[3]. Optional reed relay for all models is $4.00. The Brown Brothers keys are priced at $20.95 for the Model BTL and $24.95 for the Model CTL. Further information on all these products may be obtained from Curtis Electro Devices, Box 4090, Mountain View, California 94040. —*W2AEF*

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[2] Brown Brothers Machine Co., 5370 Southwest Avenue, St. Louis 39, Mo.

[3] A kit for assembling a memory, programmed by the customer himself, also will be available. It consists of 6 IC's and 150 diodes to be installed on a glass-epoxy circuit board in a manner according to the data to be programmed. Price will be $49.95.

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SELL: Swan 260 Cygnet, $360. HQ200, $200; Heath Code Oscillator, $7. All mint condition. J. G. Swaney, 10403A 46th Avenue, Apt. 105, Beltsville, Maryland. 20705.

TRANSFORMERS REWOUND, Jess Price, W4CLJ, 411 Gunby Avenue, Orlando, Florida. 32801.

QRRR—HELP: Model 15 TTY Crank needed. WB2APX, 118 East Columbine Road, Wildwood, New Jersey. 08260.

FOR SALE, ATTENTION QRPer's, ICM MODULES OX and PAX-1, professionally assembled, crystals for 7015 and 7142 kc, Lafayette I.F. and audio modules. $15.00 for lot or sell individually. W2CVW, 13 Robert Circle, South Amboy, New Jersey. 08879. Phone: (201) 721-0755.

FOR SALE: National NCXA POWER SUPPLY—Speaker converted to NCXB with both schematics, $45.00. WA4MXD, 3417 South Griffith Ave., Owensboro, Kentucky. 42301.

SELL: IRE PROCEEDINGS: 1945 thru 1964 complete. Good condition. Make offer; you pay shipping. W9WX, 825 North Street, Geneva, Ill. 60134.

SALE: New DX-150 Realistic Receiver, $80.00. Richard Hennis, 3409 Sevier Drive, North Little Rock, Arkansas. 72116.

ONE Cabinet (75A series), $15.00, excellent. One-HP-13 D.C. Power Supply, $40.00; One- HX-20 Transmitter with HP-20 AC power supply, $125; One-HW-32 Transceiver (20MTR) with HP-23 AC power supply, $110.00 and crystal calibrator; One- KE93 Receiver W/AC power supply, $100; All include manuals. You pay shipping. All equipment works well. John C. Supple, 3529 Coronado Court, Ft. Worth, Texas. 76116. TEL: (817) 244-1776. K4TUK/5.

WANTED: 2-meter transceiver. Sidewinder or similar. PAoFM/W2. 52-29 39th Avenue, L. I. C., New York. 11104. Phone: (212) 458-2627, after 6 P.M.

THE OLD OLD TIMERS CLUB welcomes all amateurs to join its ranks if you have been licensed for forty years. Send your QSL card to Chas. W. Boegel, Jr. W0CVU, 1500 Center Point Road, NE, Cedar Rapids, Iowa for an application blank.

SALE: Globe V-10 VFO, $29.50; Astatic JT-30 Mike, $7.00; DK60G2C 110V Relay, $8.00. F. Strickhausen, WA0NLR, 715 Tyler, Apartment 36, Topeka, Kansas. 66603.

SELL: Wagner 3600-0-3600 Xfmers at 1 amp. Dual 110/220 pri, $25. Collins 30S1, $800; 312B4, Mint, $130.00; HQ110, $89; CE 10B, $39. Rev. Bittner, 814 Fourth Street South, Virginia, Minnesota. 55792.

HQ-129-X RCVR. FB Condx. $50. WB6ZWS, 5113 Arvada, Torrance, California. 90503.

FOR SALE: High quality TMK VOM's. Below wholesale. J. A. Worcester, R. D. 1, Frankfort, New York. 13340.

SWAP MY COLLINS 32V3, HQ170, and Heath Ham Scan for your SSB/CW Transceiver. Tom Dornback, 19W167 21st Place, Lombard, Il. 60148.

FOR SALE: Drake 2A receiver. Looks good, sounds great. $125.00. Don Whitney, K5GKN, Box 249, Osceola, Ark. 72370.

TERMLINE WATTMETER 30 to 500 MC URM-43B like new, with case, $75; G.E. Prog. Line 450 MC MT-42 T-Power, $75. W. J. Davis, 4434 Josie Avenue, Lakewood, California. 90713.

ESTATE of the late WA7IID: Swan 250C, 117XC, TV-2. Contact: Dan, W7FCD, 4602 N. 75th Way, Scottsdale, Arizona. 85251.

T-33 Mosley Tribander Antenna; unused, $120.00. Reginald C. Reindorp, 641 Hathaway Dr., Macon, Ga. 31204. Telephone: (912) 746-5816.

EIMAC: 2 ea. 4CX300A/X578, new, $20 ea., One SK-710 socket, new, $20 (for 4CX300). T. Hopkins, Box 396, Faison, North Carolina. 28341.

SELL: HW-32A, VOX, CAL, $99.00. W2GJJ, C. Vinson, 2796 Larkspur St., Yorktown Heights, New York. 10598.

WANTED: NAVIGATOR; Drake TV-1000-LP; 4-BTV and RM75S resonator. Carsner, W0MN, 935 Geary Street, San Francisco, Calif. 94109.

LAMPKIN 105A micrometer freq. meter; perfect cond. $135.00 postpaid. J. Wasiewicz, 229 Sarles La., Pleasantville, N. Y. 10570.

LAFAYETTE HA225 RECEIVER, S. W. & 6-160 Mtrs, Ameco Preamp, 100KC crystal - cost $178, SELL: $85. Geffner, 48 Park Ave. East, Merrick, New York. 11566.

SELL/TRADE Swan 250C with noise silencer & 117 XC Mint $450. Johnson Challenger Xmtr, $50-Donald Bowman, 350 McKnight St., Ashland, Kentucky. 41101.

SELL: HEATHKIT SB-400 5 band xmitter, excellent condition with manual. $200. Al, K6PO, 6248 Snowbond, San Diego, Calif. 92120.

RTTY WANTED: Model 15 KSR and/or table. Good condition. Make reasonable offer. D. Evans, 320 Grand St., Alameda, Calif. 94501.

WANTED: Transmitter, receiver, & antenna donations for struggling junior high school radio club. Donations Tax deductible. Also need 5 Motorola VHF FM rigs. R. Eckton, E. M. Cope Junior High School, 1100 W. Cypress Ave., Redlands, Ca..92373.

807W TUBES: Have 21 unused. One or all at $2.00 ea. PPD U.S.A. WB6ZWS, 5113 Arvada, Torrance, California. 90503.

NOVICES: HW-16 with crystals-$93.00; Adv. Licensee wired, tested, Made only 14 contacts. C. E. Moore, 3329 March Lane, Garland, Tex. 75040.

DRAKE W-4 WATTMETER. Excellent condition. $40.00. W8TXX, Box 1111, Benton Harbor, Michigan. 49022.

MOBILE CW 40 Mtr XTL Controlled xmtr with power supply, $25. W6BLZ, 528 Colima St., La Jolla, California. 92037.

WANTED: Schematic and manual, assembly literature for Heathkit VFO VF 1 Gerald von Klein, WA9GYF, 348 West Main, Reedsburg, Wi. 53959.

LAFAYETTE HE-80 Ham and SWL rcvr. Full ham bandspread 10-80M. $64.00 FOB, includes speaker, calibrator, manuals. Matt Lefkowitz, WB4KRR, 379 Florida, Herndon, Va. 22070.

TEMPO ONE, Brand new, used about 8 hrs.; AC Supply, speaker with cabinet, mobile mount; all for $380. Reason- unforseen (medical). W9FG. 428 Dorr, Antigo, Wis. 54409. Douglas Lovelace.

FOR SALE: Heath HW 12A, HP23 AC supply, HP 32 DC supply, speaker, mike, cables, etc. $150. W2FEI, Martin Rexsen, 493 Oxford Rd., Cedarhurst, N. Y. 11516.

FOR SALE: Collins 301-1 linear; also 312B-4 Console. First certified check or MO. for $400.00 gets both. SN- 13815 and 56492... Like new with manuals. WA5TJA, 2920 Wood St., Texarkana, Texas. 75501. PH- (214) 793-2515.

SELL: HALLICRAFTERS SX-101A, like new, $175.00; Ant. Match, handles 2KW easy, w/2KW ant. relay and ant. selector, $75.00. Dave Rempel, WB6JML, 7681 Hanna St., Gilroy, Calif. 95020.

BRAND NEW DRAKE R4B shipped prepaid for $365.00. G. Sochor, 419 S. Euclid, Oak Park, Illinois. 60302. Still in box.

28 ASR & KSR CONSOLE CABINETS, LESU with line test switch for sale or trade. D. C. Harrington, 1620 Gardenia Ave., Fridley, Minn. 55432.

HAM-M ROTATOR, new, never used in sealed carton, $119.95. Ronald M. Nagata, W6RQZ, 1330 Curtis St., Berkeley, Calif. 94702. Tel: (415) 526-7345.

SALE OR SWAP: General Radio Model- 720-A Het. Freq. Meter. Freq. 10 mc. to 3000 mc. $150.00 or ?. Jim Gysan, 53 Lothrop St., Beverly, Ma. 01915.

HEATHKIT HW-100 XCVR for sale, unmodified & factory aligned, with HP-23, HP-23 AC P/S, SB-600 SPKR and Shure 444 MIC. Buy all for $299 & get a Heathkit HD-15 Phone Patch Free! I will ship f.o.b. or you pick up and get a Mosley TA-31 antenna or Hy-Gain 80-40 M antenna traps, and insulators and W2AU 1:1 balun-center insulator. Both, plus an antenna switch, for an extra $16.00 on pick-up only. Richard L. Mangum, WN7NCZ, P. O. Box 744, Provo, Utah. 84601. Telephone: (801) 373-8654 anytime person-to-person.

SELL OR TRADE for best offer Atwater Kent Model 40 es Spkr E-3 works. S. Kertes, 911 Elizabeth, Joliet, Illinois. 60435.

FOR SALE: Globe V-10 VFO (160 thru 6 meters). 1177 Tube Tester (like new), Universal Boardmaster Drafting Machine with 18" & 6" Scales-First reasonable offer, general Class License Course, $4.00 ($10 new), American Society for Metals, Machining Course (15 lessons and tests) $20 (cost $70), Will consider trade, my Xclnt HW12-A for HW17-A in same condition. W. E. Kindred, 4874 Woodway Drive, Fort Wayne, Ind. 46815.

30 - S - 1 • AMP. 2 KW - PEP Drake TR3 - Exciter, 1 -4 CX 1000 tube, AMECO Pre-Amp. $1000.00. Call: (212) 528-8056, New York City area.

HEATHKIT DX-20 w/xtals, $25.00; GR-64, $30; IO-21 scope with "How to use Scope" course, $50; Howard Hecht, 96 King St., Bridgeport, Ct. 06605.

WANTED: Will buy antique and old telegraph instruments for my collection. Goodman, 5826 S. Western, Chicago, Illinois. 60636.

SELL: Morrow Falcon Ham and BDCST. Band Receiver with A.C. supply-speaker, 12V.D.C. Dyna., $45.00. W6DIZ, 3748 Floresta Way, Los Angeles, California. 90043.

1 — ROHN 40 Ft. Crank-up TOWER, 1 yr. old for $135.00. A local sale is preferred. K2GQO, 131 Saddle Rock Rd., Valley Stream, Long Island, New York. 11581. (516) PY 1-7354.

SWAP: Hallicrafter HT40, Heath HR20 rcvr. Want Drake 2B rcvr. K5LHO, 2016 Flat Creek Drive, Richardson, Texas. 75080.

FOR SALE: Dow Key Coax Relay (OK-60-a), $15.00 - this relay is brand new); first and second Phone course, slide rule, both for $20.00; Heathkit Trans. Intercom for $10.00; CODE practice Osc. (AMECO), for $10.00, mint; Basic Electricity, 5 Vols. and Basic Electronics, 6 volumes, by Rider. Both for $8.00. H. T. Hastings, 13445, Highway B, El Cajon, California. 92021.

SELL: 30 Amp Filament Chokes for GG Linear Amplifiers. Perfect for pair 4-400A, 3-500Z, 813's, or single 3-1000Z, 4-1000A, etc. $5.00 each, postpaid USA. Vonn R. Murrell, K4HHA, 712 Rich Rd., Newport, Tennessee. 37821.

FOR SALE: 2 new National MB40 All-Band Tank Assemblies. $6.00 each. Glenn Lay, 109 No. 32nd Avenue, Yakima, Washington. 98902.

SB-200 KW LINEAR, $195.00; Ronald M. Nagata, W6RQZ, 1330 Curtis St., Berkeley, Calif. 94702. Telephone: (415) 526-7345.

TOROIDS, 88 mh, uncased, 5/$1.50, pp48, E. W. Evans, K4OEN, 220 Mimosa Lane, Paducah, Kentucky. 42001.

FOR SALE OR TRADE FOR ANTIQUE WIRELESS GEAR: Collins KWM-1, w/Noise Blanker, Mobile Mount, H.B. AC Power Supply, Manual, Hall HT-37 mint, like new, manual; Hall HT-3 Lin. Amp. Clean, with manual. Interested in Atwater Kent, Crosley, Grebe, Kennedy, Federal, RCA, West. Anything in The Early 20's. S. B. Weidner, W0QW, 1131 S. Main, Ottawa, Kans. 66067.

WANTED: National 1-10 or HFS. State condition and price in first letter. Roger Zeran, K0HRX, Box 271, Grandview, Mo. 64030.

GENERAL STATION: Drake 2-C Heath SB-400 2CS 2AC. Bargain great shape, $300. Edward Benson, WA2DFD, 216-16 85th Avenue, Hollis Hills, N. Y. Phone: (212) 776-5669.

WANTED: Schematic Pictorials or any info on grid drive modification for T-150 xmtr. Buy or borrow to copy. WN1MWB, Jack Jones, 9 Terrace Ave., Noank, Conn. 06340. 536-3731.

FOR SALE: Swan Cygnet 260. Excellent condition. Going CW QRP. First check for $325. WA1NDX, 30 Imlay St., Hartford, Ct. 06105.

WANTED: Borrow to copy, manuals for RME 4300, Viking Mobile Xmtr. Will return promptly S. Olster, 7 Washington Street, Methuen, Ma. 01844.

FOR SALE: Drake 2B receiver with 2-AC calibrator and book. Looks and performs like brand new. $175.00. B. Nastoff, 320 W. 56th Pl., Gary, Indiana. 46410.

FOR SALE: Home Brew Headquarters for Building components for 4-1000A final including power supply. Bill Brown, W0SYK, 28 Marine Lane, Hazelwood, Mo. 63042.

MINT SURPLUS: 110v. APR-5A 1000-6000 Mc. RCVR. dir. readout, $150.00. IP69C/ALA2 panadaptor conv. to 110 v., 30 Mc input, $45.00. You pay shipping. K9BUG, 2004 W. Purdue, Muncie, Indiana. 47304.

SELL: Collins exciter 310C-2, $30; 310B, $50; 708A-1 master osc., very stable 2-4.2 Mhz. $200. Robert Ireland, Pleasant Valley, N. Y. 12569.

FOR SALE: Heathkit HW-12, 80 Meter transceiver, used for one year. Excellent condition, assembled and tested by engineer. Make offer. D. S. Bugnolo, WA1JLV, 71 Canonchet Dr., Portsmouth, R. I. 02871.

WANTED: Unconverted Prop Pitch Motor. Sell: 3600-0-3600 at 1 amp Xfmr $25, 1 1/2 amp, $40 FOB. W0AIH, 814 4th Street South, Virginia, Minnesota. 55792.

FOR SALE: Large Prop Pitch Motors, excellent condition; in original crate. $45. W5CCP, J. A. Boyer, Box 10703, Midwest City, Okla. 73110.

WANTED: To Borrow: June 1968 'Ham Radio,' Will xerox and return. Joe Wegner, Jr., POB 262, Glendale, Calif. 91209.

SELL: HW-32 and HP-23, $100; P & H LA-400C Linear, 800 watts pep, $75; DX-40, $35; Twoer $35; HA-5 VFO, $40. WB8HAT, 19 Curtis, Athens, Ohio. 45701.

SX101A, $189; BC-348, $65; Telrex 20m beam; 38' unguyed mast, Rotator, $65.00. 45' Tritower, $25.00. All pick-up, only. Offers OK. K5MVN, 113 Woodcrest, New Iberia, La. 70560.

SELL: Conar 400 in vry gd cndx for $20.00. Knight T-60 pr cndx, $25.00. Lafay Ha-63 rcvr, $25.00. WN4LHK, Chris Adams, 118 Wendover Circle, Oak Ridge, Tenn. 37830.

CANADIANS: Complete amateur equipment service by fully-equipped lic'd technician, kits wired-serviced. Bob Fransen, VE6TW, 227 Cottonwood, Sherwood Park, Alta.

WANTED: Low Band Motorola 41V for 6 meters 12 volt, rear mount with controls. W. H. Westacott, W7FXA, 1840 Marshall, Richland, Wash. 99352.

RANGER I, 65W CW or AM, 10 M thru 160M, $40.00. W1OHJ, 35 Whipple Road, Lexington, Mass. Phone: (617) 862-0895.

FOR SALE: National 200, $200.00 or best offer. HA-5 VFO, best offer. Both little used but in excellent condition. K7VPR, 2011 Clifford, Pullman, Wn. 99163.

WANTED: Tri-Band Beam. Prefer to deal within the state unless you are willing to pay the shipping. Jack Bernath, W0MRD, 2936 Virginia, Cold Springs, Colorado. 80907.

SELL: Mobile D.C. Power Supply. Eico 752 at 750 V.-300 MA., 250 V- 170 MA., -100V 5 MA. 12.6 V.A.C. 3-8A. Like new. $45.00. H. A. Johnson, 6305 Redbird Terrace, Clinton, Oh. 44216.

HAM TRANSFORMERS REWOUND. Jess Price, W4CLJ, 411 Gunby Avenue, Orlando, Fl. 32801.

SELL: Gonset G-66 Receiver in good condition; circuit, manual, $29.00. C. E. McDougall, 72 Laurel Crest, Madison, Connecticut. 06443.

WANTED: General Coverage Receiver suitable for SWL'g. Will pick up within a 50 mile radius, or ship. Ernie Doane, K1WRO, 26 Myrtle Street, Lynn, Mass. 01905.

E. EU CLUB seeks help and assistance through SM3VE.

CRYSTALS: SASE for latest list. K8LJQ, 351 Mower Road, Pinckney, Mich. 48169.

SELL: Hallicrafters Co. Model SX-140 6-80 meters with speaker, $55. F.O.B. N. Y. C. Sig. Grabel, WB2GFB, 40 Argyle Rd., Brooklyn, New York. 11218.

HAM Transformers rewound, Jess Price, W4CLJ, 411 Gunby Avenue, Orlando, Fla. 32801.

SELL: HW-100 & HP-23 a.c. pwr. supp. Perfect. $250. Will ship coll. John Eiland, Neill House Apts., 37A, Auburn, Ala. 36830.

TWO WIRE RECORDERS, A Webster and a Wireway, w/several spools recording wire. $10 takes all. M. Lefkowitz, 379 Fla. Ave., Herndon, Virginia. 22070.

SR150 MR150 PS150-12 WHIP & MOUNT, $300. 3KW 115V 60 cycle alternator, $70; Polycom 62B 110AC/12V complete $150. Art Ford, 9 Havermeyer Lane, Commack, N. Y. 11725.

DOCTORS DIRECTORY: Over 1500 M.D., D.D.S., D.V.M., D.O. listed. Send $2.00 for this invaluable reference to Secretary International Doctors, C. H. C. Chapter number 24. Dr. Wm. Fulcher, K4RTA, 105 Freshrun Drive, Hendersonville, Tenn. 37075.

GALAXY OWNERS: update your earlier Galaxy equipment to the 500 watt level of the newer MK3 and GT-550 and add other desirable features: SASE for info. WA5DAJ/8, Box 171, Fairfield, Ohio. 45014.

SELL, SWAP HALLICRAFTERS SR-75 Transceiver, $45; SP-44 Panadaptor, $45; S-76 Rcvr, $75. T. Gosman, 143 Roxton Rd., Plainview, New York. 11803.

APACHE XMTR FOR SALE: Gud novice, xmtr, 75-180 watts cw, am, xtal or VFO. Only $70. Will ship. Eugene Gascho, 1064 S. Brown Rd., Pigeon, Michigan. 48755.

SB-301, mint condx. With CW, AM filters. $275. Knight R-100A rcvr with product detector. $80. WB8AME, 1114 S. M-52 Owosso, Mich. 48867.

EIMAC 4-400A/ Jan 8438 tube, brand-new for sale. Won at St. Cloud A.R.C. hamfest. Best offer. Jeff Jackson, 510 Maryland, Duluth, Minn. 55803.

WANTED: 80—40 Transceiver name particulars and price first letter; also have for sale QST and CQ and 73 Magazines at 20 cents each plus postage. Name what you want. Write: L. M. Covey, K1JAR, 238 Jenness St., Lynn, Mass. 01904.

WANTED: Old Crosley Model X or XJ 4-tube batery radio and 1922 - 1924 Radio News. W7KE, 1109 S. 2nd, Hamilton, Mt. 59840.

FOR SALE: "Riders' Perpetual Trouble Shooters' Manuals" - 1930's. "Gernsbach Official Radio Service Manual" - 1930. Make offer to K5ENL, Ed Block, Grandview, Texas. 76050.

WANTED: (4) new 1625 tubes. Tony Glorioso, 2500 Gehb Avenue, Baltimore, Maryland. 21227.

BASE STATION. 152 mc FM 50W output with manual. $85. No shipping. (914) 769-9331. J. Wasiewicz, W2DQC, 229 Sarles Ln., Pleasantville, New York. 10570.

COLLINS R-388/51J3, $325, RCA AR-77E, $75. Both w/prod det SSB, 550kc-30MHz; Hallicrafters S-36 FM/AM 27-143 plus, $49; R-220 AM/FM/CW 20-240 MHz, $450. Trade VHF/UHF SASE W4API, Box 4095, Arlington, Virginia. 22204.

SELL: HX-10 180 PEP SSB, $200; DX-40 and HG-10 VFO, $45; S2OR Rec., $35; BC 312N w/ 12 VDC DYN, $60. Will ship. J. E. Short, 1240 East 6th St., Sheldon, Iowa. 51201.

ANYONE INTERESTED in joining a Jaesu FTDX-560 Club, please contact: W8GV, Phil Bieglecki 11820 Engleside, Detroit, Mich. 48205. for exchange of ideas.

SELL: NC-98 Receiver & Matching Speaker; Heath OL-1 Oscilloscope; ART 6V & 12 V Battery Eliminator. Name your price. P. H. Kromayer, 1832 Jennings St., Bethlehem, Pa. 18017.

COLLINS 32V2 excellent RTTY xmtr with 150 watt 2 mtr Xmtr, power & mod. by 32V2. Together or separate. R. Mendelson, 27 Somerset Pl., Murray Hill, New Jersey. 07974.

MODEL 19, TD14, Typing Reperforator, line unit, Power Supply and AFSK TV., $200.00. W6JX, 14945 Dickens Street, Sherman Oaks, Ca. 91403.

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VERY, VERY CHEAP: Transformers, chokes, resistors, capacitors, fuses, plugs, sockets, controls, etc. Stamp for list to: J. Coffield, W2DDZ, 40 Mitchell Avenue, East Northport, N. Y. 11731.

WANTED: Instructograph or Garder code machine, beginners' tapes, electric or spring operated, oscillator not necessary. Earl W. Carsner, 283 No. Colorado Street, Chandler, Az. 85224.

WANTED: Mods for casting toy lead soldiers, indians, etc. Will buy or trade ham equipment or old tubes such as 201A. D. McKenzie, 1200 W. Euclid, Indianola, Iowa. 50125.

NOVICES, WRL Duo-Doublet 80-40 M antenna, new, $5.00. Mosley NS-3 80-40-15 M Antenna, used, $10.00. 10 Novice xtals for 80 (2), 40 (4), and 15 (4) for $9.00. Mosley Coil-center insulator for 33 foot 40 M dipole, $4.00. Dick, WN7NCZ, P. O. Box 744, Provo, Utah. 84601.

FOR SALE: SB101, HP23A, Speaker, EV641 MIC. First reasonable offer. TR44 Rotor, $25. Speed-X Bug, $10. Phil, 4874 Woodway Drive, Fort Wayne, Indiana. 46815.

WANTED: Self-supporting crank-up tower. At least 50 ft. T. Hoitenga, K8NGV, 26496 W. Six Mile, Detroit, Mich. 48240.

E. EU CLUB seeks help and assistance through SM3VE.

SELL: Western Union Model 1034 RTTY, $65.00, Power Supply 1200 Volt, 700 mil for $50.00. W5LXG, 7950-8 Locke Lane, Houston, Tx. 77042.

FOR SALE: IRE proceedings and Associated IRE publications 1958 thru 1962. Ed Block, K5ENL Grandview, Texas. 76050.

SELL: TWO WESTINGHOUSE 5KV-A Pole Pigs, $10 each. 120/240/2400 volts. Jim Higgins, W2CWK, RD 1, Box 189-E, Jamesburg, N. J. 08831.

WANTED: Afro-American hams interested in an Afro-American net. Contact: W3BRX/8, Denison University, Granville, Ohio. 43023.

SWAN 400 406 VFO 405MARS PWR sup $375; JOHNSON Match Boxes 275W no swr, $35; KW modified $85; HP13, $45; New G150 2M AM, $75. Art Ford, 9 Havemeyer Lane, Commack, New York. 11725.

FOR SALE: GONSET G-28 10 meter communicator for $125; GPPI Phone Patch, $30; 3-30 mobile converter, $15; Heath DX-40, $50; 10'er, $45. Robert W. Cook, Rt. 1, Box 132A, Warrenville, Illinois. 60555.

HEATH WANTED: HG-10(B) VFO in good working condx. $29 or less. WN6MDP, 6664 Lake Park Drive, Sacramento, Calif. 95831.

DRAKE W-4 Wattmeter in excellent condition. $40.00. W8TXX, Box 1111, Benton Harbor, Michigan. 49022.

WANTED: Complete Audio Limiter Module for Central Electronics 200V. State price and condition. Jerry Vanaskey, 4540 Foster Drive NE, Louisville, Ohio. 44641.

SELL: Galaxy V Mk 2 with Vox, Cal. $279, AC supply $55; Also, HW 12A with Cal. $79, AC Supply $25. All mint cond. Send certified check. FOB. WA0QZT, Minden, Iowa. 51553.

FOR SALE: Hallicrafters HT-46 with a matching SX-146 Rcvr. Both $450.00 with match. SPKR., A1 condx. Also sell, Apache TX-1 XMTR.-$75.00 or best offer. Will ship P. Pd. J. A. Boniface, WB2AII, R.F.D.2, Box 393, Middle Island, N. Y. 11953.

WANTED: Collins receivers, transmitters, or linears that are in bad or non-working condition and thus, selling cheap. Older sets, okay. Give model, condition and lowest price in first letter. W. C. Small, 27828 E. 15th St., Hayward, California. 94544.

FOR SALE: Antique radios, etc: A—K, 10B—20—30, Fr. Ei. NR-5 NR-7, NR-12, CR.51, SW—3, SW-5, FB—7, Hal S-11 S—16 Buddy, RME—69, PR—10 Breting 9, Grebes, Horns, Cones, QSTs 1928-1942, RCA 20—28 —OP 2A three carbon mike input port amp. Many more. SASE. Joe Horvath, 522 Third St., San Rafael, California. 94901.

R390A/URR- Mint condition. Best offer takes it. Paul Wentzel, K0GBC, 16278 Florida Way, Rosemount, Minn. 55068. Phone: (612) 432-8106.

HALLICRAFTERS HT-46 SSB/CW xmtr. Brand new-- has never been plugged in! $195. W6GGT, 1925 Bidwell Way, Sacramento, Calif. 95818.

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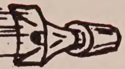

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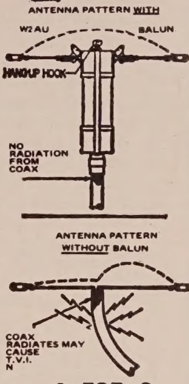

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SELL: NCX-500 AC500 brand new condition, $385. Harry Taubin, W2GCW, 192-15A 69th Ave., Flushing, N. Y. 11365. (212) 454-2775.

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SELL: Galaxy GT550, RF550, SC550, AC400, VOX 35C, CAL 25, mint, in original cartons, $550 FOB. Walt Atkins, 1609 Valley Road, Champaign, Illinois. 61820.

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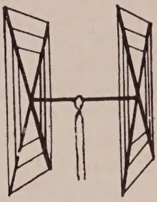
W3



CUBICAL QUAD ANTENNAS — these two element beams have a full wavelength driven element and a reflector; the gain is equal to that of a three element beam and the directivity appears to us to be exceptional! ALL METAL (except the insulators) — absolutely no bamboo. Complete with boom, aluminum alloy spreaders; sturdy, universal-type beam mount; uses single 52 ohm coaxial feed; no stubs or matching devices needed; full instruction for the simple one-man assembly and installation are included; this is a fool-proof beam that always works with exceptional results. The cubical quad is the antenna used by the DX champs, and it will do a wonderful job for you!

10/15/20 CUBICAL QUAD SPECIFICATIONS

Antenna Designation: 10/15/20 Quad
Number of Elements: Two. A full wavelength driven element and reflector for each band.
Freq. Covered: 14-14.4 Mc. 21-21.45 Mc. 28-29.7 Mc.
Shipping Weight: 28 lbs. Net Weight: 25 lbs.
Dimensions: About 16' square.
Power Rating: 5 KW.
Operation Mode: All
SWR: 1.05:1 at resonance
Gain: 8.1 db. over isotropic
F/B Ratio: A minimum of 17 db. F/B
Boom: 10' long x 1¼" O.D.; 18 gauge steel; double plated; gold color
Beam Mount: Square aluminum alloy plate incorporating four steel U-bolt assemblies. Will easily support 100 lbs. Universal polarization.
Radiating Elements: Steel wire, tempered and plated, .064" diameter.
X Frameworks: Each framework consists of two 12' sections of 1" OD aluminum 'hi-strength' (Revere) tubing, with telescoping ⅞" tubing and short section of dowel. Plated hose clamps tighten down on telescoping sections.
Radiator Terminals: Cinch-Jones two-terminal fittings
Feedline (not furnished); 52 ohm coaxial cable

Now check these startling prices—note that they are *much lower* than even the bamboo-type:

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10-15 CUBICAL QUAD	32.00
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(all use single coax feedline)

GOTHAM

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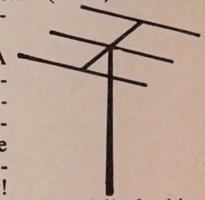
The first morning I put up my 3 element Gotham beam (20 ft) I worked YO4CT, ON5LW, SP9-ADQ, and 4U1ITU THAT ANTENNA WORKS! WN4DYN Compare the performance, value, and price of the following beams and you will see that this offer is unprecedented in radio history!



Each beam is brand new; full size (36' of tubing for *each* 20 meter element, for instance); absolutely complete including a boom and all hardware; uses a single 52 or 72 ohm coaxial feedline; the SWR is 1:1; easily handles 5 KW; ⅞" and 1" alumnium alloy tubing is employed for maximum strength and low wind loading; all beams are adjustable to any frequency in the band.

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4 EL 20	34*	4 EL 6	20
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3 EL 15	21	12 EL 2	27*
4 EL 15	27*	***20' Boom**	
5 EL 15	30*		

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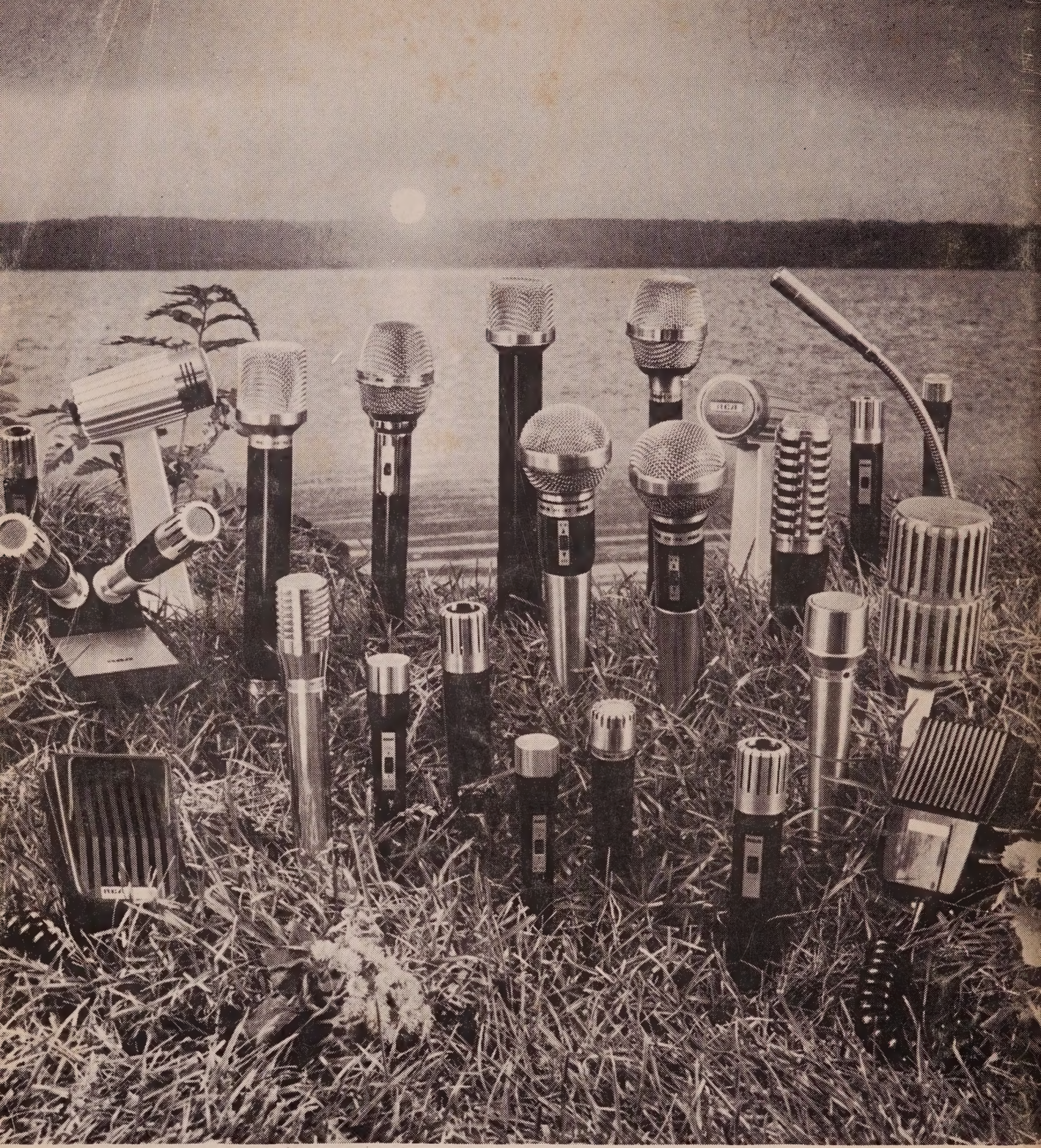

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